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Electrical Trade with Russia?

ALTHOUGH the Soviet Government has now existed for over ten years, Russian affairs are still veiled in a haze of doubt and conjecture which is tinged with political and other prejudices of many colours. Some "authorities" claim that the country has settled down to a period of smooth progress, while others, no less trustworthy, as far as we are able to judge them, report that the economic position is extremely serious. Upon one matter, however, both those who admire the Soviet Government and those to whom it is anathema are agreed; it is that Russia cannot go on without external aid. It seems clear that the rigid Communism of the revolution has given way before the realisation that "capitalism" possesses many attributes which are indispensable to the modern State. Consequently the Soviet Government has found itself forced not only to adopt some of the methods of "capitalism," but even to encourage and invite foreign capitalists to assist in the country's reconstruction.

In the electrical industry, for instance, we find that the Swedish A.S.E.A. has been called in to advise upon and superintend the construction of electrical machinery, &c., and, as we reported in our last issue, the Company is actually erecting a very large works. Moreover, in 1927 the Metropolitan-Vickers Electrical Co., Ltd., entered into a five-year agreement with the Leningrad Machine Trust by which the Trust obtained access to the Company's laboratories, workshops and patents. (*Vide* ELEC. REV., March 25th, 1927, p. 471). This is quite apart from the extensive importation of electrical plant from the leading industrial countries, the latest development of which is a large contract placed with the International General Electric Co. valued at between one and two millions sterling. Some information respecting this contract and the conditions which attach to it as regards the settlement of old Russian obligations towards the American company has just been received. From this it transpires that the International General Electric Co. of New York and the Amtorg Trading Corporation, of New York, have signed, under date October 9th, 1928, a contract covering the supply of electrical apparatus for export to the Union of Soviet Socialist Republics (Russia). The contract provides for the purchase on the part of the Amtorg Corporation of not less than $5,000,000 or more than $10,000,000 worth of apparatus and material

during the first two years. A payment of 25 per cent. is required before shipment of the materials, and the balance is to be covered by trade acceptances falling due within a period of five years from date of shipment. Provision is made upon the satisfactory completion of the purchases during the first two years, for the continuation of the contract for a further period of four years, involving purchases of not less than $4,000,000 annually. The contract and all acceptances bear the unconditional guarantee of the Russian State Bank. It has been stated by the president of the International Company named above (Mr. Clark H. Minor) that the negotiations resulting in this contract have been carried on for more than a year with the knowledge of the State Department. "We have satisfied ourselves," says Mr. Minor, "that there is nothing in the contract which conflicts in any way with the policy of our Government, with which we are in entire accord." The further interesting statement is also issued by Mr. Minor:—"Provision is made upon the completion of this contract for the settlement of all claims of our Company against the Soviet Government arising from decrees and actions of that Government with regard to the nationalisation or annulment of property rights relating to our interests in Russia. Our claim is approximately one and three-quarter millions of dollars."

During the last few years we have made a practice of publishing whatever electrical information we could secure through the usual channels. At times, in view of the practical impossibility of doing trade on a safe basis, it may have seemed that we were simply wasting our space, especially as it was so difficult at times to tell whether news received could be treated as reliable or whether it was tainted either at its source or on its way. Lately the customary sources have to some extent dried up, and what has come has suggested that chaotic conditions did not indicate much reason for displaying more exceptional enterprise in Russia, than in Empire and other markets, until the situation was more hopeful.

The particulars given above regarding the contract for electrical goods placed in America have reached us simultaneously with information from other sources on the general situation, and this we pass on in case the electrical industry may find it of any service in guiding it as it waits for the time when Soviet Russia shall find it worth while to do stable trade with us on safe and honourable terms, abandoning its evasion of past responsibilities.

The matter before us is, however, far from encouraging, for notwithstanding what has been said with reference to Swedish, British and American business, and the realisation of the necessity for foreign capitalist and technical assistance, chaos is understood to reign not only in the electrical manufacturing industry, but also in the execution of schemes and the importation of machinery and plant. Anyhow, this impression is drawn from the lengthy details which have lately been published in the Moscow official newspapers. The production of high-pressure plant is centred in works in different parts of the country as far apart as Leningrad and Kharkoff, and combined in the form of the G.E.T. or State Electrical Trust. It is unlikely that the officials of the Trust would depreciate the value of its achievements, so we may first refer to a report prepared for the consideration of the Supreme Council of National Economy by Messrs. Maksimoff and Vlados, who are on the board of management of the Trust. They report that during the past three years the branches under the control of the Trust have increased their output by 130 per cent., whereas the expansion in all the other native industries has only been 102 per cent. in the same period. If down to the war the value of all the production in the high-pressure branch did not exceed 55,000,000 roubles, in the present year (1928-29) the output of the G.E.T., according to the financial plan, is to represent 166.2 million pre-war roubles. In this way the production this year should exceed the pre-war level in the heavy branch by over 200 per cent. Notwithstanding this contemplated development, it is stated to be impossible for the Trust to keep pace with the demand for its products, while in the case of machines alone the deficiency is growing. The output has been a declining one. Market requirements in this branch were met to the extent of 63 per cent. in 1925-1926, but the percentage fell to 56 and 48 per cent. in the following years, though in other branches of the manufacturing industry under the Trust's control the demand could be met.

It is considered that the heavy electrical engineering works can only be developed if there is a revision of the policy of the Supreme Council of National Economy in respect of the financing of the Trust. The provision for capital expenditure has been quite inadequate, and difficulties have arisen in obtaining adequate supplies of raw materials. We have come so thoroughly to discredit Soviet estimates that we hardly know whether to add the forecast that if the foregoing difficulties are overcome it will be possible to meet 81 per cent. of the market's requirements by the year 1933.

Further light (if that is the right word) is thrown on the subject by a criticism of the General Electrical Commission by Mr. Z. Almazoff, which appeared recently in a Moscow economic journal. This Commission controls the electricity supply industry of the Soviet Union. Mr. Almazoff accuses it of proceeding with the erection of power stations without regard to necessity or cost. For instance, in order to guard against the possibility of Russian works not executing orders, contracts for similar plant have been placed abroad. In other cases some parts have been ordered from Russian works and others from foreign countries, with the result that serious difficulties have arisen in assembly. Mr. Almazoff calls upon the Supreme Council of National Economy and the National Commission of Trade to make an investigation of import operations and the productive activity of the manufacturing industry.

All of the foregoing emphasises the need of Russia for foreign aid. Sweden, the United States, and Germany realise the position and are conducting operations with Russia subject to certain precautionary measures. Many British manufacturers, too, are watching the situation closely, and this observation should be maintained so that opportunities for remunerative trade on a sound basis may not be missed, due regard being paid to the fulfilment of past obligations.

Inter-Imperial Trade.

The question of British Empire trade development must not be regarded as a political one. It is ever becoming increasingly a question of supreme national importance. We at home form part of an Empire which contains vast resources, and if these can only be properly exploited they can be turned to such good account as to find employment for many of our population, through the great opportunities that they present for enterprise and trade. We have no wish to compare that great potential market with European possibilities; that is apparently the subject of a difference of view between the Minister for Foreign Affairs and Lord Melchett, as expressed by the latter in a speech at the Empire Industries Association on November 29th. But we do think it is timely to emphasise the frequent articles that have appeared in the Electrical Review relating to the need for utilising British financial, engineering, industrial and commercial ability and enterprise in taking in hand the development of British Empire resources, the immensity of which has been reported upon again and again by Commissions and at Imperial Conferences. We organise our industries for productive and control purposes at home, but we need more co-operation and consolidation of enterprise in Empire development to feed those industries with business for many years to come. An examination of the latest returns of our electrical export

trade shows how our sales to various parts of the British Empire and Dependencies have been increasing. This is without any what we might call extraordinary effort, and we can confidently anticipate that our exports to British overseas markets will continue to increase from year to year; business already in hand will help, and we hope for more of like kinds before long. But it is worthy of serious joint consideration whether some new concentration of effort would not give a most gratifying impetus to such business, also whether we could not with Empire co-operation do more than is being done already to keep foreign competition in check. There is something attractive in Lord Melchett's remark that if we could develop the interior natural resources of the Empire, we should have something greater than had ever been known before. "Instead of talking about England being the workshop of the world we should be thinking of the workshop of the British Empire." The question, he added, must be kept before Britain and the Empire at large; they might say that it could not be done, *but there was nothing that could not be done if they wished to do it*. He advocated a conference of big business men in this country and in the Dominions who would work out a scheme of inter-Imperial trade, paying due regard to the aspirations of the Dominions to develop their industries, and at the same time enabling us to do a great deal more business than we had ever done before. The speaker stressed the foolishness of adhering to opinions of years ago when circumstances had altered. He and many important men in industry had entirely changed their views on important matters as the conditions were so very different to-day.

Birmingham I.E.E. Dinner.

THE annual dinner of the South Midland Local Centre of the Institution of Electrical Engineers, held at Birmingham on Friday last, was more than ordinarily enjoyable. Mr. Frank Hodges, a member of the Central Electricity Board, paid a cordial tribute to the technical ability and the breadth of vision of British electrical engineers, which had led to the conception of electricity supply as a service of national rather than parochial, importance. Perhaps too much emphasis was laid upon the word, for Mr. Hodges throughout his speech spoke of the "National Electricity Board," though no one can be more fully aware of its correct designation, and although he specifically attributed its origin to engineers, and not to politicians, it is well known that amongst the latter are those whose aim it is to "nationalise" electricity supply in the fullest sense, if they ever have the opportunity. *Absit omen!* The Board was expressly designed to be independent of political influence; but its existence provides an instrument by means of which it would be only too easy for a Socialist Government to convert the public electricity supply industry into a department of State, with the disastrous consequences inseparable from State ownership and management.

A point that was rightly commended by Mr. P. V. Hunter was the fact that of all the huge contracts placed by the Board, not one had been sent out of the country; moreover, he expressed admiration of the businesslike way in which the negotiation of the contracts had been carried out. Incidentally he laid himself open to an amusing comment from the Bishop of Birmingham, who, after enduring various excursions into the science of "eschatology" on the part of previous speakers, genially turned the tables on his tormentors with the best speech of the evening, adorned with incisive wit, delicate humour, and profound scientific erudition. Dr. Barnes was not made a Fellow of the Royal Society for nothing.

Electricity Charges in the London Area.

THE decision of the London and Home Counties Joint Electricity Authority to undertake a "review" of the charges and conditions for supplies of electricity within its huge area, which was announced last week-end, is of interest to a very large number of consumers, the quantity of energy sold in the District in 1926-27 amounting to nearly 500 million kWh for lighting and domestic purposes, and more than that for power. The inquiry arises out of a letter from the Electricity Commissioners to the Authority suggesting that the latter should take up the matter, and pointing out that any advance towards uniformity of charges that might result would benefit the public and promote the development of the supply of electricity. The Authority's Statistical Return, recently reviewed in our pages, showed how very widely the prices and conditions varied, the flat rates for lighting ranging all the way from 3d. to 10d. per kWh, and the average price received from less than twopence to more than 7d. The average price for power also varied from between ½d. and 1d. to 5d.

It must be admitted that the conditions under which electricity is supplied in the District, which includes comparatively thinly populated townships as well as the most congested manufacturing and residential areas, are as diversified as the prices charged, and we would not suggest that even the highest prices in the list were always or necessarily excessive; it is, however, well known that in fairly comparable areas the terms imposed by some undertakings are nearly double those charged by others. In these comparisons, as we have shown from time to time, the companies—with notable exceptions—appear in an unfavourable light.

The desirability of carrying out a detailed survey of the matter can hardly be questioned, but whether effective steps towards securing uniformity can be taken, in the absence of statutory powers to that end, is not so certain. The London companies are securely entrenched behind their special Acts and the sliding scale, and one cannot but admire the skill with which they have conducted the negotiations with the London County Council and the Electricity Commissioners. The local authorities have not the same privileges, but on the other hand, in many cases their charges are already remarkably low, and they generally aim at making further reductions when that is possible.

Patents and Inventions.

INVENTIONS may be made and letters patent may be obtained in respect of them; they may be very clever inventions too, and yet they may not be "commercial propositions" in the sense of sound business enterprise. Unfortunately, however, they may be very well adapted for exploitation by unscrupulous financial adventurers, whose only aim is to foist them on the public and get away with quick profits and small returns, so to speak. It is difficult to protect the non-technical investor in such cases; even if sufficient time intervenes between the issue of a prospectus and the closing of the list, to enable the technical Press to comment on the matter, it is not likely that any warning that may appear in its pages will reach the lay reader. We welcome, therefore, an excellent letter in *The Times* of November 28th, in which Mr. H. C. Siddeley, a well-known authority on electrical trade, after referring to "the growing movement in the City to exploit on the Stock Exchange newly formed companies who are trying out on a commercial scale, and at the expense of the public, mere paper inventions," sets forth the points regarding which the investor ought to satisfy himself before parting with cash. These points include the adequate protection of the invention by both British and foreign patents, actually issued; the technical importance of the invention; and above all, the commercial value of the invention as a tried and proved device or process. His warning was energetically supported in a later issue by Mr. A. A. Campbell Swinton, who has had 40 years' experience in the commercial development of patented inventions, and strongly deprecates the practice described above, pointing out also that the directors of such companies are often "inexperienced, if ornamental." Immense injury is inflicted on genuine industry by these immature and wasteful flotations.

Manchester Electricity Undertaking.

Some details of the Barton Power Station No. 2, which constitutes a 40,000-kW extension of the original 82,500-kW section of what is probably the most efficient steam-driven electricity generating station in the British Isles.

THE official inauguration of the Barton Power Station No. 2 of the Manchester Corporation Electricity Department by the Lord Mayor, Councillor Lieut.-Col. G. Westcott, O.B.E., on November 29th, recalls the formal opening of the original section of the generating station in October, 1923.*

To accommodate the new plant it has been necessary to add a second bay to the boiler house and to erect new turbine and switch houses. The new buildings are similar, and occupy corresponding positions, to the original ones, but on the opposite side of the enlarged boiler house, which is central as indicated in fig. 1.

Three Babcock & Wilcox marine-type water-tube boilers have been installed, two of which are chain-grate fired and the third burns pulverised coal; the last-mentioned has been erected in the original section of the boiler house. Each is equipped with an economiser, superheater, air heater, forced- and induced-draught fans, and a steel chimney with a grit arrestor. The stoker-fired boilers are of somewhat different design from those first installed, and their steaming capacity is 30,000 lb. per hour greater each. The normal evaporative capacity of each is 130,000 lb. per hour, and the maximum rating 150,000 lb. per hour, and 170,000 lb. per hour in the case of the powdered-coal boiler, which contains 810 water tubes, 462 tubes in its economiser, and 2,220 tubes in the air heater; its total heating surface is 42,139 sq. ft., compared with each chain-grate boiler's 58,277 sq. ft., the grate area of which is 559 sq. ft. The p.f. furnace is provided with water-tube walls, protected with slabs of refractory material, and a water-screen floor; ten of the fuel burners are vertical and four horizontal. The "bin and feeder" system is utilised: from the 10-ton per hour driers, wherein its moisture content is evaporated by hot flue gases, the coal is admitted to the 3.25-ton per hour pulverising mills and thence pumped (mixed with compressed air at the rate of 12 tons per hour) through pipes and pneumatically-operated valves into bins, whence (after being weighed) it is fed to the burners. Operation is controlled from an upper platform, the pulverising plant from the basement, and the pneumatic valves from the firing floor; the distance from the firing floor to the centre of the boiler drum is no less than 40 ft. A magnetic separator removes "tramp" iron fragments from the fuel prior to its pulverisation, and 33 motors are needed to drive the auxiliaries of this boiler. The steam gauge pressure is 375 lb. per sq. in., and its temperature at the superheater outlet 750 deg. F. The boiler feed-water temperature when it leaves the last heater is 300 deg. F., steam being bled from four stages of the main turbine, and the flue gas final temperature 294 deg. F. (333 deg. F. in the case of the powdered-coal boiler) with 11 per cent. (13 per cent.) CO_2 at the air heater outlet.

The new boiler feed-water pumps are housed in the basement; two of them are motor driven and the third steam-turbine driven. All the motor-driven pumps are of Mather & Platt make, all the auxiliary-plant motors being of the 3-phase, 50-cycle, a.c., 420-volt pattern.

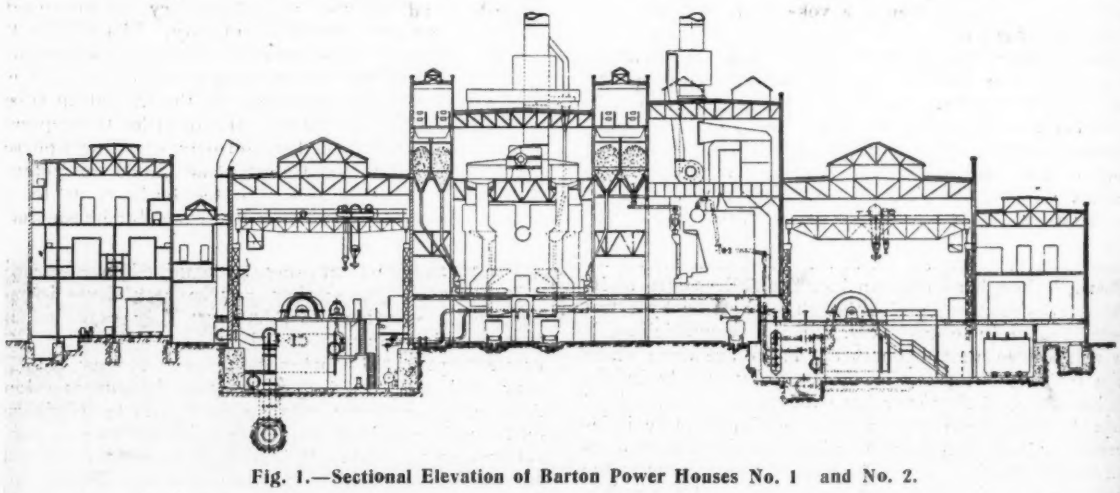


Fig. 1.—Sectional Elevation of Barton Power Houses No. 1 and No. 2.

The new generating set (fig. 3) was built by the Metropolitan-Vickers Electrical Co., Ltd. The steam turbine is of the Rateau, impulse, 2-cylinder design, its h.p. and l.p. portions being flexibly coupled in tandem: the h.p. stages number 23 and the l.p. stages 16 plus the multi exhaust (18 wheels), the mean diameter of the h.p. blading being 3 ft. 6 in. and that of the last l.p. wheel over its blade tips 10 ft. 3.5 in. (fig. 2); at full speed the velocity of the blade tips of the last wheel is 808 ft. per second, or 551 miles per hour, the speed of the machine being 1,500 r.p.m.

The turbine, main generator, house-service generator, and exciters are all semi-flexibly coupled in line on one shaft, the overall length of the set being 83 ft. 6 in.; a separate motor-driven exciter has been provided as a stand-by.

The main 50,000-kVA, 6,600-volt, 3-phase, 50-cycle, 0.8 p.f. generator is the largest so far constructed in

* Elec. Rev., June 22nd, p. 979, and Oct. 19th, pp. 571 and 579, 1923.

England, the total weight of its complete rotor being over 100 tons. It is of similar design to those previously installed, and requires 100,000 cu. ft. of air per minute to ventilate it on the closed-circuit principle; the area of the air cooler is 15,600 sq. ft., it being fed with water derived from the main condenser circulating-water system. The 1,250-kVA, 420-volt, 3-phase, 50-cycle, 0.8 p.f. house-service set requires 4,000 cu. ft.

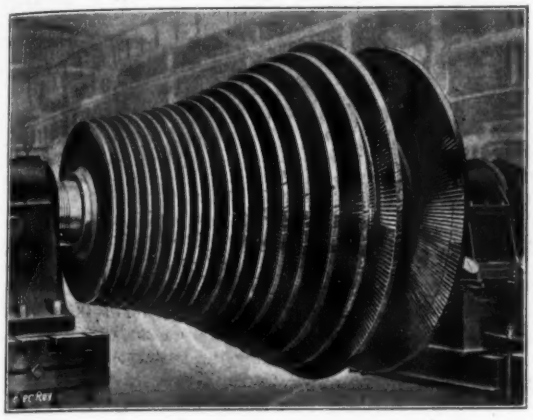


Fig. 2.—Turbine L.P. Rotor, 10 ft. 3.5 in. in Diameter.

of ventilating air per minute. The main set (108-kW, 215-volt) and house-service (15-kW, 98-volt) exciters are accommodated under one yoke and ventilated by means of rotor fans.

The Richardsons, Westgarth contraflo-regenerative steam condenser has a cooling surface of 32,000 sq. ft and needs 2,005,000 gallons of water per hour, which is circulated by two 280-b.h.p., 588-r.p.m., motor-driven pumps, each with a capacity of 17,600 gallons per minute under a 38-ft. head. The only water culvert modification needed has been the lengthening of the inlet. Each of the motor-driven, 670-g.p.m., 970-r.p.m., 60-b.h.p. condensate pumps is capable of dealing with full-load extraction, but both of the 168-lb. per hour, three-stage, steam-operated air ejectors are required to maintain the vacuum of 29 in. Hg.

The whole of the energy generated at 6,600 volts is stepped up to 33,000 volts. The two main Metropolitan-Vickers transformers, each of 25,000 kVA capacity, operate in parallel and are the largest so far made in the British Isles; each weighs 69 tons, and they were transported complete and filled with oil. The house-service transformer is of 1,500 kVA capacity.

The a.c. 420-volt auxiliary station switchgear and the field-breaking pillars for the main and house-service alternators are of the Metropolitan-Vickers metal-clad type.

The new main 33-kV switchgear was supplied by the British Thomson-Houston Co., Ltd., as was that in the Barton No. 1 station also. The alternator-transformer connectors include isolating links, the main switching being done on the 33,000-volt side, while the metering transformers, &c., are on the 6,600-volt side. The main busbars are sectionalised between groups, while the auxiliary busbars, with the exception of the air-break switches, are continuous throughout, an oil circuit breaker connecting Barton No. 2 and No. 1 stations.

The switchgear is of cellular construction (fig. 4), on two floors, its arrangement being generally similar to that at Barton No. 1, but by the provision of busbar selector switches only (instead of busbar isolators and selectors) a very considerable saving in space has been obtained. The oil circuit breakers are of the type OH.28, which incorporates the "explosion pot" principle, requires a small quantity of oil (only 4-1/3 gallons per phase), and has a long break of 40 inches per phase. In the case of the 33-kV busbar-selector and feeder-isolating switches, vermin-proof shutters have been provided where the operating rods pass through the cell doors, the switches being remote mechanically operated in gangs of three from outside the cells.

Instrument current transformers are of the bar-primary pattern in circuits of 600-ampere capacity and upwards, and of the wound-primary oil-immersed pattern in circuits of smaller capacity. The 6,600-volt metering-current transformers for the generator equipments are also of the bar-primary pattern, and each is provided with a metallic lining in the insulating tube which is connected to the primary in order to suppress corona. All potential transformers are single-phase oil-immersed, and a feature is that no 33,000-volt potential transformer is connected to the busbars, or to a generator, without an oil circuit breaker for its control.

Fig. 3.—The New Two-cylinder, 40,000-kW, 1,500-r.p.m., Steam Turbo-alternator Set.

In the case of the generators, the potential transformers require, naturally, to be connected to the generator side of the main oil circuit breaker for the purpose of synchronising, but a special non-automatic oil circuit breaker is provided to enable the potential transformer to be disconnected from the main circuit, except when required for short periods for synchronising.

Each potential transformer is protected with current-limiting resistances and fuses mounted in the tank.

which is on wheels and so interlocked that it cannot be disconnected unless the magnetising switch has first been opened.

Reactors are employed to connect the main busbar sections and in series with the service transformers; the latter arrangement is an important feature, since a fault on a house-service transformer becomes practically a short circuit on the busbars, and the reactors thus limit the damage to the transformer itself and also help to maintain the voltage on the busbars.

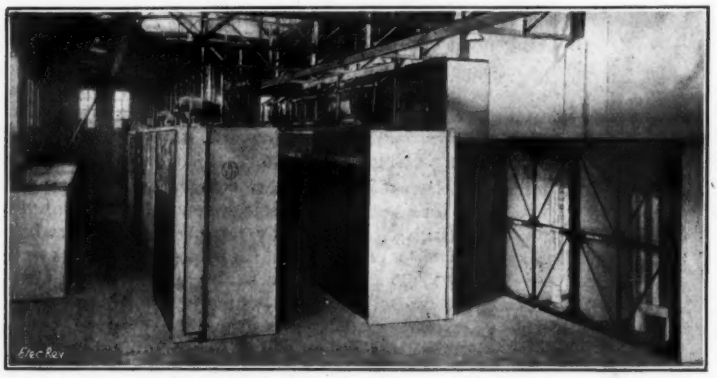


Fig. 4.—Oil Circuit-breaker and Reactor Cells (right).

Protection consists of circulating current across a combined generator and transformer with the addition of core-balance leakage on the 33,000-volt transformer winding, and separate leakage for the generator and 6,600-volt transformer windings, the latter being operated from a current transformer mounted in the neutral earthing equipment of the generator. One core balance transformer is mounted in each of the four cables connected to the 33,000-volt transformer windings, actuating a two-pole relay on the control panels. In addition, each generator is provided with an instantaneous overload relay, normally short circuited, but open circuited during synchronising. The house-service transformer is provided with plain overload and earth leakage protection on the 33,000-volt side, and the feeder protective gear is of the Merz-Beard pattern, while the protection for the main and auxiliary bus interconnections between the two stations is of the Ferranti-Hawkins type.

The control panels (fig. 5) form an extension to the board in Barton No. 1 station. When No. 2 station is ultimately completed, the formation will still be in the shape of a U with a very long base. An interesting feature is the provision of a "series safety switch," which is normally open and in series with the closing circuit of the oil circuit breaker; thus it is necessary first to close the "series safety switch" and then operate the breaker by means of the control switch, the former then being returned to its normal "open" position.

No. 2 station is provided with summation metering equipment, which consists of one recording wattmeter in the control room, and indicating wattmeters in the boiler house and resident engineer's office. The extensions were designed, the plans and specifications prepared, and the constructional work supervised by Mr. H. C. Lamb, M.I.E.E., M.I.Mech.E., city electrical engineer, and his staff (which numbers 501, in addition to 1,734 other employés), Messrs. C. S. Allott and Son having been responsible for the civil engineering work. They have increased the plant capacity at Barton to 122,500 kW (*i.e.*, 10 boilers and 3 27,500-kW sets, plus two boilers and one 40,000-kW set) representing approximately three-quarters of the site capacity.

On March 31st, 1928, the installed plant capacity of all stations was 209,150 kW; the coal consumption during the year was 327,381 tons, and the energy generated reached 449,511,830 kWh. The maximum demand on the system was 154,110 kW; sub-stations of 500 kVA and over numbered 24 a.c. and 33 d.c. The number of consumers was 49,474, aggregating 351,276 kW connected, the capacity of industrial motors connected being 172,344 kW. The capital outlay on the Corporation's undertaking has reached £9,944,355, its loan debt being £5,368,329 and the amount standing to the credit of the reserve fund £169,668. The revenue last year amounted to £1,604,167.

On Thursday last week the new extension was formally inaugurated. In the presence of a large company of citizens and visitors, who had previously inspected the original works, the Lord Mayor opened the new turbine-room with a gold key, and declared the extension open, and afterwards the chairman of the Electricity Committee, Alderman W. T. Dagnall, started the 40,000-kW turbo-alternator. In the evening a dinner was given by the Corporation, at which the Lord Mayor presided, in the great hall of the Town Hall, there being some 250 guests.

Proposing the toast: 'The Manchester Electricity Undertaking," Dr. S. L. Pearce, C.B.E. (chief engineer, London Power Co.), referred to the controversy over the selection of the site in Dickinson Street for the first power station, when some held that the site was inadequate, whilst others thought Manchester would never need so large a station. Now the capital outlay was 10 millions, the annual output 450 million kWh, and the consumers numbered 53,000. Moreover, the output had been doubled in the last five years, and the number of domestic consumers quadrupled. He attributed the success of the undertaking to its strong sales policy with efficient serivce, up-to-date engineering methods, co-operation with neighbouring authorities, and a sound financial policy.

Fig. 5.—Main Control Boards.

The Radiological Exhibition.

Whilst the author, who visited the show on our behalf, found nothing of a revolutionary nature on view, the display provided evidence of a definite tendency towards improving the engineering design of the apparatus, particularly the high-voltage generating equipment.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

(*Concluded from page 928.*)

Points of Interest.

The firms showing X-ray plant and tubes were :—

G. C. Aimer & Co., Ltd.
Cuthbert Andrews.
Cox-Cavendish Electrical Co., Ltd.
Philip Creswick.
A. E. Dean & Co.
General Radiological Co., Ltd. (Continental).
Medical Supply Association.
Newton & Wright, Ltd.
Philips Lamps, Ltd.
Schall & Son, Ltd.
Solus Electrical Co.
Victor X-ray Corporation, Ltd. (U.S.A.).
Watson & Sons (Electro-Medical), Ltd.
X-Rays, Ltd.

In addition, five photographic materials manufacturers exhibited films, &c., for X-ray work.

A four-valve set of typical design was shown by A. E. Dean & Co. A wooden cabinet contains the transformer with the four rectifying valves mounted above it. A wooden control table is provided, and no attempt is made to shield live conductors with earthed metal. The control embodies a dual feature, permitting the screening of a patient to be performed with a small current through the tube, and a rapid change to a heavier current for the radiographic exposure. A point-plate spark gap is fitted on the cabinet.

The General Radiological Co. exhibited sets embodying both mechanical rectifiers and A.E.G. thermionic valves. The majority of the plant is mounted in earthed-metal cases. The peak voltmeter is connected to a tertiary coil of the main transformer, and a point-point spark gap is mounted on the cabinet. A novel feature is a compensating device for maintaining the thermionic rectifiers at full emission during exposure. On switching-on, the line voltage falls, due to the heavy load, and the filaments tend to dull. By their arrangement a boosting winding on the filament-transformer core carries an additional magnetising current which is proportional to the load current, so that the filament current is maintained at its normal value whatever the current taken from the mains may be. A large tube-stand was a centre of interest, consisting of a bakelite cylinder about 4 ft. in length mounted to swing about a horizontal axis. Illustrations were shown of the Company's 1929 apparatus, capable of delivering one ampere to the X-ray tube. Other apparatus known by the names of "Heliodor," "Peo," and "Stabilivolt" was shown, the last-named being a condenser set for maintaining the voltage throughout the cycle; fig. 4 shows its electrical circuit.

Fig. 3.—A Newton & Wright 110-kV Transformer and Mechanical Rectifier.

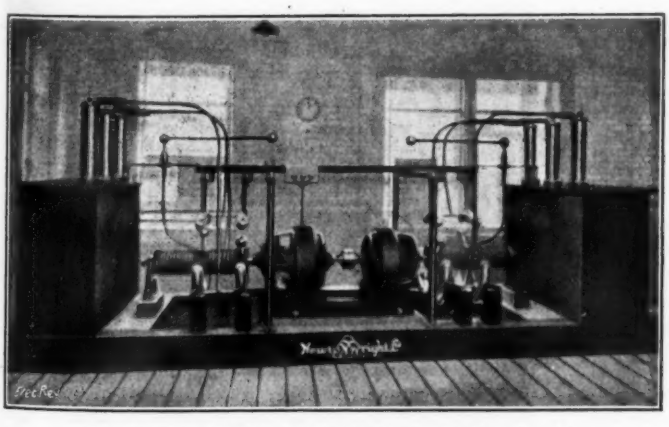


Fig. 2.—The Middlesex Hospital Installation, London.

The "Practitioner's Own" X-ray outfit shown by the Medical Supply Association is a relatively small and inexpensive installation for private practice. In another set a transformer and single-valve rectifier are used, the plant being mounted in a wooden cabinet; provision is made for a "Metalix" tube.

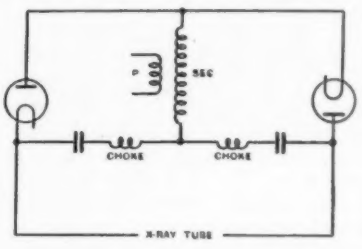


Fig. 4.—The Circuit of the General Radiological Co.'s "Stabilivolt."

Newton & Wright, Ltd., exhibited a number of all-metal screening stands and couches. Their generating plant consists of both transformers and induction coils,

and both thermionic and mechanical rectifiers; the latter have been manufactured by them for twenty years. Fig. 3 shows a transformer complete in metal tank, with its mechanical rectifier and synchronous driving motor mounted vertically above, and fig. 2 is a three-phase installation for the Cancer Research Department of the Middlesex Hospital. The transformers will be seen at the sides of the illustration, with the mechanical rectifier running horizontally. This plant is essentially an

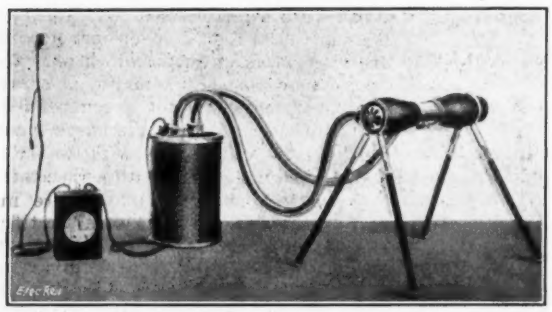


Fig. 5.—"Metalix" Portable X-ray Outfit.

engineering job, and follows the modern tendency to install the heavy plant in a sub-station instead of in the operating room. The highest working voltage of this outfit is 250 kV peak, and the use of a three-phase supply leads to a nearly constant voltage wave.

Valve sets consist of one or four valves, and they are operated at constant filament voltage to stabilise running conditions throughout their life. Approximately equal numbers of mechanical and valve rectifier plants are now sold.

The controls embody the following features: the kilovoltmeter is connected to the transformer primary so as to read before the exposure is made, considered desirable on account of the short exposures now given. The foot switch has the "dual control" feature previously mentioned, and on the control table the local circuits are interlocked with the main switch to ensure correct sequence of operation. British instruments are used throughout.

Philips Lamps, Ltd., are the patentees and makers of the "Metalix" X-ray tube now so widely used; in addition, thermionic (or hot-kathode) rectifiers are made, and a portable X-ray outfit was also on show. The "Metalix" tube is made in several forms and sizes. The actual "line" on the anti-kathode is of about 1.2 mm. square effective area on account of the inclination of 19 degrees to the perpendicular to the kathode-ray axis. Fig. 5 shows the portable set, which can be packed for transport in two units. In the illustration it is shown set up for use, and is complete for use on a.c. mains. The voltage applied to the X-ray tube (a "Metalix") is 65 kV, and the whole is completely insulated on both primary and secondary leads. The flexible leads to the tube consist of armoured cable of the condenser bushing type, the negative being a concentric lead for the X-ray tube filament. The armouring is earthed and the live tube terminals are also covered with earthed metal. The consumption of electricity is so small that it may be used on ordinary lighting mains, and so is of particular use for portable work, including use in private houses.

The six-valve, three-phase, plant by Schall & Son is shown in fig. 6. The main three-phase transformers are each in separate tanks. Six Philips rectifiers are mounted vertically on top of the transformers, and ammeters are provided for each filament, as well as separate rheostats for primary control. Their tendency is towards high-powered outfits in a separate room from the operating room, and "six-feet radiography" is an accomplished fact, using tubes either below the floor, or above the ceiling, of the operating or treatment room. The apparatus is mounted in a wooden case, but the control board is of all-metal construction.

The Solus Electrical Co. exhibited, amongst other apparatus, the six-valve set shown in fig. 7. The porcelain insulators supporting the rectifiers and leads are oil-filled, and the various power units are contained in earthed metal cases. The working voltage is 120 kV peak, and the usual feature of the nearly constant wave-form with three-phase units is, of course, present. The current rating is 100 mA. Three transformers with secondaries in star are used, instead of the alternative of one three-phase transformer. The control is extremely good, as it consists of a three-phase induction regulator controlled from a distant and movable control board. In this way the voltage variation is steady, unlike that obtained from tappings on an auto-transformer. A dual control foot switch is also fitted so that quick change-over from the small current for screening to the heavier current for radiography may be made. A time-switch is, of course, also incorporated. This firm has supplied about 200 Philips thermionic rectifiers in the last two years, with the somewhat remarkable record of only four failures in that time.

The Victor X-Ray Corporation is associated with the American General Electric Co., and so supplies the Coolidge tube, which is made in England by the British Thomson-Houston Co., Ltd. All its apparatus incorporates mechanical rectifiers, and apparatus of various sizes and outputs was on view. The dental set is an extremely neat apparatus, as the illustration (fig. 8) shows. A stand carries the apparatus at the end of an extending arm, movable in any direction. Primary (l.p) leads only are taken to the apparatus swung on this arm, which consists of a protective oil-filled tank carrying both the transformer and the Coolidge tube. The latter is a miniature tube only some four inches long, but is quite capable of dealing with all dental work. The Victor-Kearsley stabiliser is a feature of the control gear of this firm's apparatus, and consists of a relay which maintains the filament current of the X-ray tube at a constant value independently of whether the tube

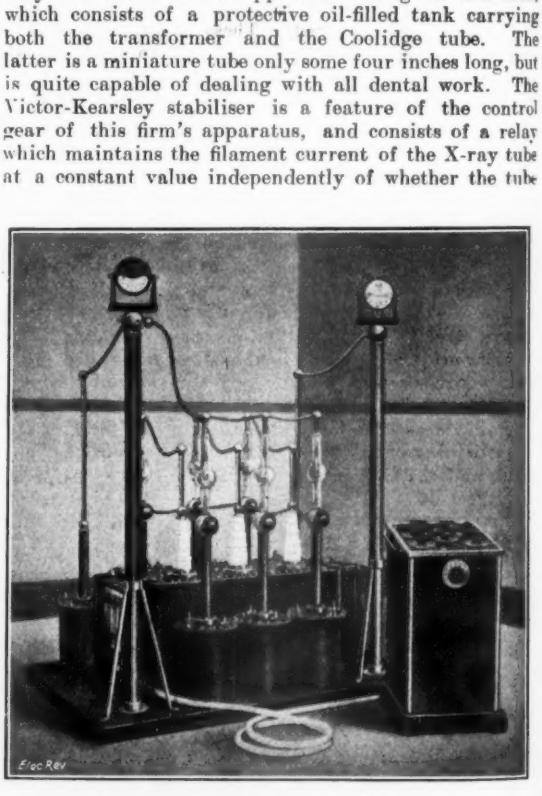


Fig. 6.—Schall Three-phase, Six-valve Plant.

is excited or not. Normally the filament current is passed through a resistance which is short-circuited by the relay traversed by the X-ray current, so that on load the reduced line voltage is compensated for by the cutting-out of the series resistance. A variety of Coolidge tubes was on view, ranging in size from the dwarf dental tube to the 250-kV deep-therapy tube, capable of carrying 50 mA continuously; the latter is a water-cooled tube.

Messrs. Watson showed a number of types of apparatus. One of their standard lines is illustrated in fig. 10, and consists of a transformer bank in a steel case with the four rectifying valves mounted horizontally above. This is a compact set, and the illustration shows the transformer raised above its tank

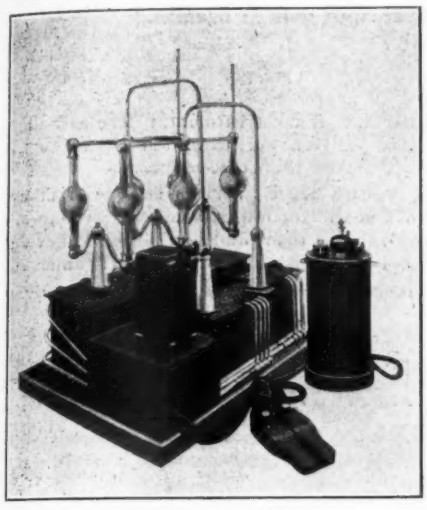
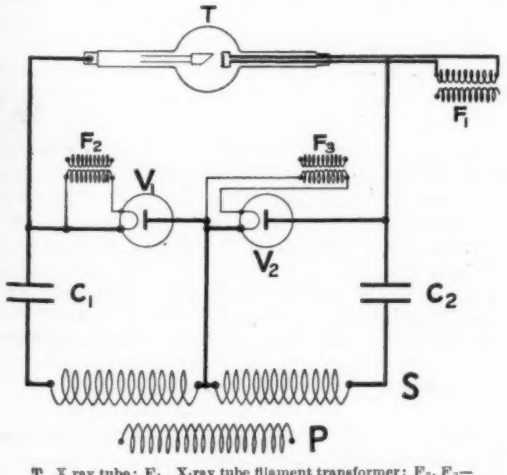


Fig. 7.—"Solus" Three-phase Six-Valve Set.

Fig. 8.—Victor Mobile Dental Equipment.

and the valves omitted. These valves are British-made "Osram" E.H.T. 3 rectifiers, and are rated to withstand 150 kV reverse voltage. The main transformer is of the shell type, whilst the filament transformers are separately wound on a common iron core carried above the main transformer. Porcelain insulators carry the e.h.p. leads out of the tank to the valves. This transformer is built to the new B.S. specification for transformers for X-ray work. Fig. 9 is a circuit diagram of the "Pulsating Current Generator," which is designed to give impulses of 200 kV. This consists of a transformer with centre earthed, each half being rated at 50 kV only. By means of the rectifiers and condensers, the latter are charged to 50 kV each every half cycle, so that on the reverse half cycle the condenser discharge plus the transformer voltage delivers a total of 200 kV to the X-ray tube, the centre



T X ray tube; F_1, X-ray tube filament transformer; F_2, F_3—Valve tube filament transformers; V_1, V_2—Hot kathode valves. C_1, C_2—Condensers; S—Secondary winding high voltage transformer; P—Primary winding high voltage transformer.

Fig. 9.—Pulsating Current Generator Circuit.

of the circuit being earthed. The condensers are each of 0.03 μF., of the condenser bushing type in air.

In addition to the British rectifiers, British instruments are also used throughout. The X-ray tubes mainly supplied are "Metalix" and Muller, but Cooldge and gas tubes are also available.

Messrs. X-Rays, Ltd., exhibited a 4-valve set for working at 150 kV peak, and up to 250 mA at 125 kV peak. The rectifiers are mounted vertically with individual filament voltmeters, and a special point is the provision of a green lamp in each filament circuit, so that a possible failure is shown up, as the rectifiers and transformers are mounted in a closed wooden cabinet. The British-made instruments include a peak voltmeter which operates on the transformer primary. A spark gap is fitted, but not recommended, owing to the heavy arc discharge made available by controlling with an auto-transformer instead of with a rheostat.

Other sets of their manufacture include one-valve and mechanical rectifier sets, and are provided either for "Metalix" tubes or with a protective box for Muller tubes. The dual control principle is fitted, enabling a rapid change to be made from the screening current to the radiographing, including auto-timing of the latter. This firm has installed a plant at the Brompton Hospital, where the tube is in a room below the patient, the film being 6 ft. above the tube. This is a definite advance in radiographic technique, and is highly to be commended for safety.

Accessory Exhibits.

Messrs. W. Edwards had vacuum pumps on show.

Messrs. Pye showed sensitive X-ray spectrometers for crystal analysis, electro-meters, and a Wheatstone bridge.

The photographic side of radiography was repre-

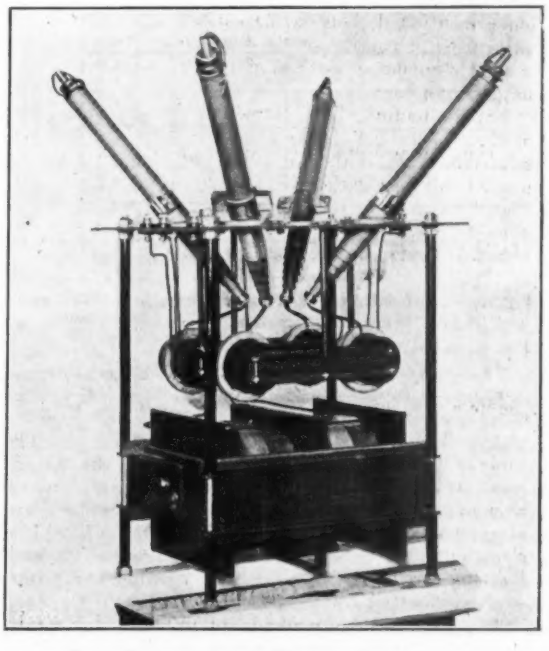


Fig. 10.—Watson Four-valve Set.

sented by Messrs. Agfa, Ilford, Imperial Dry Plate Co., Kodak, and Wellington & Ward. All films are now double-sensitised; plates appear to be obsolete. Industrial radiographs were shown on some stands, including two of modern high-power copper-anode thermionic valves: their filament grid, and even the insulation were shown up well, the penetration being through one-eighth inch copper walls (*i.e.*, total copper a quarter of an inch)

Copper-cadmium Conductors.

Experience and test results on the new alloy wire show that it possesses the pliability of annealed electro-copper, the conductivity of hard-drawn copper, and a high breaking strain and resistance to wear.

By A CORRESPONDENT.

PROBABLY one of the most important future applications for metallic cadmium will lie in its addition to copper for drawing into telegraphic, telephonic and power transmission wires. For such purposes, besides hard-drawn copper wire, a large number of brasses and bronzes are on the market and are used more or less as electrical conductors, because of some special property each one possesses. Although these special alloys have, in comparison to hard-drawn copper, a higher tensile strength and annealing temperature, and a greater resistance to abrasion, their electrical conductivity is much lower. But the discovery[1] by Smith that wire drawn from copper containing a small amount of cadmium possesses all the beneficial properties of such wires, in addition to an electric conductivity not much below that of hard-drawn copper, has led to considerable experimentation and in some places adoption of the wires for electric tramway systems.

Though it is a little early yet to make forecasts, it seems highly probable that such wire will eclipse all

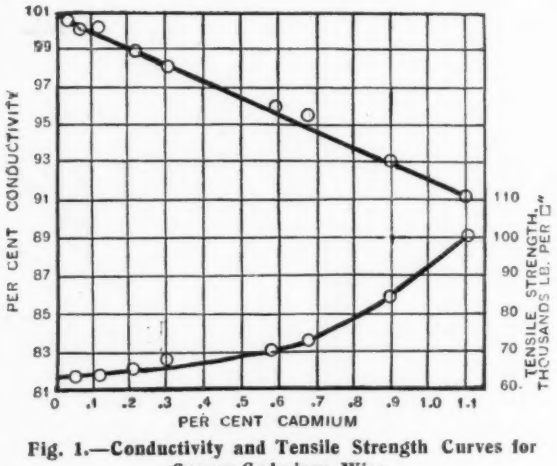


Fig. 1.—Conductivity and Tensile Strength Curves for Copper-Cadmium Wire.

other special brasses and bronzes, which in the past have been employed for purposes where durability, tensile strength, hardness, high annealing temperature and electrical conductivity are necessary qualities. The results of laboratory tests by Smith, on the tensile strength of hard-drawn copper-cadmium wire[2], and of conductivity experiments on annealed[3] samples, are summarised graphically in fig. 1. From these it will be seen that the electrical conductivity varies in inverse proportion to the cadmium content, showing a diminution of conductivity of less than 1 per cent. for each 0.1 per cent. of cadmium added. The breaking strain increases slightly as the cadmium content rises until 0.6 per cent. is reached, after which the increase in tensile strength is much more marked.

The annealing temperature of copper-cadmium wire is raised as the cadmium content is increased, and a wire containing 0.10 per cent. will withstand a temperature of 260 deg. C. for half an hour with only slight evidence of softening, while pure copper wire is dead soft after the same treatment. The cast-alloy containing 1.10 per cent of cadmium is 20 to 22 Brinell numbers harder than cast-copper.

The new alloy wire hence provides electric tramway engineers with a conductor which combines the advantages of hard-drawn copper and the bronzes, having properties comparable with the pliability of annealed electro-copper, the conductivity of hard-drawn copper, and the higher breaking strain and wearing properties of phosphor bronze, silicon bronze, and phono-electric wire. Its physical characteristics, compared with the British specification for hard-drawn copper wire (3/0 gauge), are given in Table I.

TABLE I.

	Hard-drawn copper	Cadmium-copper
Breaking strain, tons per sq. in.	24	29
Elongation, in 10 in.	3 per cent./min.	4·2 per cent./min.
Torsion test, twists in 10 in. ...	9	36
Resistance, per 1,000 yd, ohm	·2253	·2350
Bending, to right angle and back	4 times	7 times

Attention is directed to the unique properties disclosed by the torsion and bending tests which make the alloy wire altogether superior to hard-drawn copper for general handling purposes; for instance, bending into fittings, straightening, re-bending, and so on. It will be seen from the above test figures that these advantages are not obtained by any softening of the wire, or by any sacrifice of tensile strength or elongation. The results of some tests by Messrs. Riley, Harbord and Law[4] on wire drawn from wire bars containing copper 100 parts, and 1.2 parts of 50 per cent. copper-cadmium hardeners,[5] are given in Table II.[6]

TABLE II.

Brinell hardness:—	
Copper-cadmium from annealed rod	101
Copper-cadmium from unannealed rod ...	107
Copper-cadmium from unannealed rod ...	95
Izod impact tests:—	
Copper-cadmium from annealed rod ...	36
Copper-cadmium from unannealed rod ...	39
Copper-cadmium from unannealed rod ...	26

These impact tests were made on a circular section and not on the standard rectangular section; they are, therefore, comparable only among themselves.

Coefficient of Linear Expansion:—Copper-cadmium from unannealed rod = 0.0000166 per deg. C.

Resistance Temperature Coefficient: — "Constant mass" temperature coefficient between 0 deg. C. and 50 deg. C.; at 15 deg. C. = 0.00305, and at 20 deg. C. = 0.00300.

To measure the conductivity, a length of the wire 0.372 in. in diameter was further drawn to 0.137 in., and it gave the following: 0.137-in. copper-cadmium wire, 3.06 Ω per mile; 0.137-in. standard copper wire, 2.93 Ω per mile.

Thus it is seen that the copper-cadmium wire had a conductivity about 96 per cent. of the Post Office specification for standard copper wire.

Some further results on telephone wire 0.066 in. diameter, are given in the following Table III.

[1] *Chem. and Met. Eng.*, 1921, p. 1178.
[2] No. 12 B. and S. gauge = about 0.081 in. diameter.
[3] By passing 150 A for 65 sec.; annealing then complete.
[4] Thus the alloy contained approximately 0.6 per cent. of cadmium.
[5] The bars were rolled hot to ⅜ in. diameter and drawn to 0.372 in. in diameter.
[6] Kindly provided by the British Metal Corporation, London.

TABLE III.

	Breaking strain. lb.	Twists in 3 in.	Bends.	Ohms per mile.
Copper	220	30	3	12.5
P.O. bronze (copper 99.0, tin 1.0 per cent.)	345	15	3	26.0
Copper-cadmium (1.05 per cent. Cd.)	320	35	5	14.1
Copper-cadmium (1.2 per cent. Cd.)	345	35	5	17.0

Wire of this alloy has been tested on several tramway systems, and in every case showed a decrease in wear from one-half to one-quarter of that of hard-drawn copper wire under similar working conditions. This longer life of the alloy wire results in a considerable saving in the cost of replacement, and the measure of this advantage may be ascertained by taking the cost of ordinary wire, crediting it with the reduced weight it will realise as scrap, and then allowing for the number of replacements to be made during the life of the new wire. The scrap value of the latter may be taken as the same as that of ordinary wire.

Tramway engineers are always prepared to sacrifice a certain amount of conductivity to obtain a better wearing wire, especially on busy sections. The several kinds of bronzes which have hitherto been utilised for the purpose have, however, such low conductivity that their use has been restricted to short sections of the line subjected to extremely heavy wear. Cadmium-copper wire has a conductivity as high as 96 per cent. of that of standard trolley wire, and in addition, has the wearing properties of the bronzes with a pliability considerably in excess of either copper or any of the bronzes; the reliability in service from elimination of breakages and patching, which this wire gives, is an added and incalculable advantage.

Reports on the behaviour of the wire in practice indicate that the use of it has advanced beyond the laboratory stage. Both the Winnipeg and Toronto[1] tramway systems are being rapidly converted to this wire for their entire requirements. An English concern reports that "on December 3rd, 1922, a half-mile length of the wire was erected on the down track and a half-mile of ordinary hard-drawn copper trolley wire on the up track. This line under test is one of the heaviest car services, about 55 cars passing each hour." The tabulated results in Table IV give comparative figures.

The borough tramway engineer of Newport, Mon., reports that copper-cadmium wire has been extensively used in the town since October, 1920, and that it gives longer and more even wear than standard hard-drawn copper trolley wire. Test sections with rapid services and complicated crossings are under test and giving every satisfaction. The same may be said for the results of tests made upon the Brighton Electric Railway.

TABLE IV.

COMPARISON OF WEAR UPON COPPER-CADMIUM AND COPPER WIRES

Where measured	Hard drawn Copper Wire. Diam. as new.	Min. dia 4/8/23.	8 months' wear.	Copper-Cadmium Wire. Dia. as new	Min. dia 4/8/23.	8 months' wear.
Between	In.	In.	In.	In.	In.	In.
Pole 35 & 36	0.372	0.341	0.031	0.372	0.364	0.008
,, 41 & 42	0.372	0.335	0.037	0.372	0.364	0.008
,, 45 & 46	0.372	0.341	0.031	0 372	0.361	0.011
,, 50 & 51	0.372	0.340	0.032	0.372	0.360	0.012
Average ..		0.339	0.033		0.362	0.010
			(h.d cad)		(cop-cad)	
Wear per 10,000 cars passing ..			0.0018 in.		0.005 in.	
Breaks			2 at insulators		Nil.	
Approximate life allowing 0.1 in. diameter wear			2 years.		6 years.	

Note.—The wear at the striking and trailing ends of the ears is proportionately less with the copper-cadmium wire.

The results of some tests on copper-cadmium wire as compared with hard-drawn copper wire and M.T.A. standard are given in Table V.

TABLE V.

	M.T.A.	Copper wire.	Copper-Cadmium wire Sample A	Sample B
Tensile strength	24 tons per sq. in.	25 tons per sq in.	30 tons per sq. in.	28.2 tons per sq. in.
Elongation	3% in 10 in.	between 3 and 4 per cent.	4.37 per cent.	4.06 per cent.
Torsion	9 twists in 10 in.	Sample A 13 B 15	35	38
Resistance—1,000 yd.—ohms.	0.2253	0·2235	0.235	
Bending to rt. angle and back—times		Sample A 4 B 5	7	7

The above figures clearly show that copper-cadmium wire is a considerable improvement on hard-drawn copper wire. In changing section insulators it has been found that whereas the ordinary wire breaks and a new piece has to be let in, the copper-cadmium wire stands the strain of straightening and re-bending, and the linesmen report that, from their point of view, for general handling purposes and bending into fittings, the copper-cadmium wire in every way is superior to hard-drawn copper wire.

TABLE VI.

WINNIPEG ELECTRIC RAILWAY.*

Copper wire strung on one track and cadmium-copper wire on the adjacent track, installed at the same time on the busiest curve of the railway.

Normal diameter of 2/0 Trolley = 365 mils

Wear, Actual and Percentage.

Date.	Number of days' service.	Max. mils. Cad-Copper.	Max. mils. Copper.	Per cent. Cad-Copper.	Per cent. Copper.	Aver. mils. Cad-Copper.	Aver. mils. Copper.	Per cent. Cad-Copper.	Per cent. Copper.	Min. mils. Cad-Copper.	Min. mils. Copper.	Per cent. Cad-Copper.	Per cent. Copper
May 8th, 1919 -	Installed												
Dec. 21st, 1919 -	228	20	60	5.48	16.44	5	20	1.37	5.48	—	—	—	—
May 8th, 1920 -	365	—	—	—	—	15	45	4.1	12.3	—	—	—	—
Dec. 20th, 1920 -	602	30	115	8 2	31.5	—	—	—	—	—	—	—	—
Dec. 29th, 1920 -	Copper wire worn out and renewed. Estimated life of cadmium, 2,300 days.												
May 8th, 1921 -	730	40	20	10.96	5.4	30	12	8.2	3.3	15	5	4.1	1.3
March 5th, 1922 -	1,031	—	—	26.0	—	—	—	8.2	—	—	—	—	—

* On this curve 406 cars pass daily.

Reports as to Wearing Properties.[2]

The Eugene F. Phillips Electrical Works, Ltd., Montreal, Canada, has published some results of a test of its cadmium-copper trolley wire on the lines of the

[1] Information provided by courtesy of the Eugene Phillips Electrical Works, Ltd., Montreal.

[2] Abstract from *Electric Railway Journal.*

Winnipeg Electric Railway. A curve with very heavy traffic was equipped for this test. One track was strung with copper trolley wire and the adjacent track with cadmium-copper wire, each being No. 00 and having a normal diameter of 365 mils. Both wires were installed on May 8th, 1919.

On December 21st 1919, after being in service 228 days, the maximum wear on the copper wire was 60 mils, or 16.44 per cent., and on the cadmium-copper wire 20 mils, or 5.48 per cent. The average wear on the copper wire was 20 mils, or 5.48 per cent. On May 8th, 1920, after service of one year, the average wear on the copper wire was 45 mils, or 12.3 per cent., and the cadmium-copper wire 15 mils, or 4.1 per cent. On December 29th, 1920, after 602 days' service, the maximum wear on the copper wire was 115 mils, or 31.5 per cent., and on the cadmium-copper wire 30 mils, or 8.2 per cent. On this basis the copper wire was considered as worn out, and was removed and renewed with new copper wire. On May 8th, 1921, the diameters were measured after 730 days' service of the cadmium-copper wire, and 130 days' service of the replaced copper wire. The maximum wear on the cadmium-copper was 40 mils, and on the replaced copper wire 20 mils, the average being 30 and 12 mils respectively.

These results are summarised in Table VI, p. 975.

(To be concluded.)

Triode Radio Valve Quantities.

The recent article* and correspondence entitled "Radio Valve-anode Capacitive Resistance" have prompted the author to attempt an explanation of the inter-relation of the quantities involved when a three-electrode valve functions as an amplifier.

By E. FOWLER CLARK, B.Sc., B.A., A.M.I.E.E.

IN view of the apparent complexity of the subject, it is, perhaps, not surprising that the right aspect is not readily evident. Matters such as this are frequently not dealt with in a sufficiently fundamental or generalised manner, thus tending to obscure relatively simple truths in a maze of complexity.

Though the nature and application of "mutual conductance" appear to be appreciated, there seems to be some confusion concerning the whole anode resistance of a valve on the one hand, and the "a.c. anode resistance," generally called the "impedance," on the other. The whole anode resistance of a valve is essentially and always variable in operation, though fortunately its main variation can in many cases be eliminated from considerations of valve performance. The "a.c. anode resistance" is, however, in most cases desirably constant and actually reasonably so throughout the working region of a receiving, or amplifying, valve. It must be so, particularly in a low-frequency amplifying valve, and especially in a last stage, or output, valve in order to avoid the introduction of harmonic frequencies (through rectification) not contained in the grid-potential wave. The degree of uniformity of this quantity throughout the working region is *one* of the properties that distinguish good from bad valves.

In so far as mutual conductance and "anode a.c. resistance" *are* constant, *i.e.*, in so far as the family of anode current-grid potential characteristic curves of a valve are *straight* and *parallel* and *proportionally spaced* in the region utilised, the usual equivalent circuit is applicable, and the whole anode resistance of the valve does not enter into that application. The valve is then, in respect of variations of its grid potential, like a generator of voltage μ (amplification factor, also constant) times grid potential relative to steady biasing potential, having a pure internal resistance equal to the "anode a.c. resistance." This rule is a definite algebraical result and applies, not only to superposed a.c. potentials, but also to *any* grid potential superposed upon the biasing potential (see proof below). In this respect, therefore, the term "anode *a.c.* resistance" is really a misnomer, and "differential resistance" may be considered better. The load on the imaginary generator in all cases is the apparatus connected between the steady h.t. supply and the valve anode. Whatever effect the imaginary generator would produce on this load will be produced in the said apparatus as a superposed effect, *i.e.*, relative to the steady current existing in the absence of a grid potential superposed upon the steady biasing potential. The nature of the apparatus does not affect the rule. The principle is also true when the effect of the valve element capacities is taken into account in the proper manner, and only ceases to be true when operating frequencies are so very great that appreciable electron speed lag exists.

The relation between the variable superposed quantities, grid potential, anode potential, and anode current is a linear one, which is the same thing as saying that rectification does not occur in the system. It is only in so far as a valve is *not* the perfect article of our assumption that rectification is produced in an *anode circuit*, when the apparatus connected therein does not itself possess any rectifying property; for example, that apparatus may be any combination of pure condensers and non-rectifying resistances. The notion that somehow a combination of valve and apparatus, neither of which itself contains any rectifying property, brings about rectification is erroneous.

What is really meant by "rectification"? The answer *should be* that "rectification" occurs when a stimulus which in itself contains no tendency to produce a net effect in one direction (*i.e.*, a purely alternating stimulus) does actually through some additional agency (a rectifying device) become the cause of a net, or unbalanced, effect in one direction. There can be no doubt but that an alternating e.m.f. should be defined as one whose time integral is zero. If the time integral is not zero, the e.m.f. will have a net unbalanced effect, *i.e.*, a d.c. component, and will therefore not be purely alternating. A similar definition is surely right in the case of an alternating *current*.

It happens in some cases that a purely alternating e.m.f. gives rise to a current which is not purely alternating. It only occurs electrically when there is a conductance in the circuit whose static volt-ampere characteristic is not straight. The conductance is called a "rectifier" and the process "rectification."

A purely alternating superposed potential on the grid of a valve having the characteristics premised within the working range utilised, will not, by the rule, give rise to rectification in the anode circuit.

In order to prove the equivalent circuit rule and the fact that the whole anode resistance does *not* enter into the matter, we may, referring to fig. 1, proceed as follows:—

Let E be the steady h.t. potential relative, as usual, to the negative end of the filament.

* See Elec. Rev., August 10th, 1928, p. 226, *et seq.*

Let e be the steady grid biasing potential, similarly referred.

Let R be the purely (non-rectifying) ohmic resistance of the anode circuit apparatus (between h.t. supply and anode); it should be noted that this apparatus may comprise any combination of a.c. reactances, so long as R denotes its through ohmic resistance.

Let v' be the actual instantaneous grid potential.
V' ,, ,, ,, ,, anode ,,
I' ,, ,, ,, ,, ,, current.
v the instantaneous superposed grid potential, so that $v'=e+v$.
C' the steady current when v is zero, or $v'=e$.
V_0 the fall of potential due to the steady passage of C' through R.
V the *additional* instantaneous fall of potential resulting from the presence of v.
I the superposed instantaneous current resulting from the presence of v.

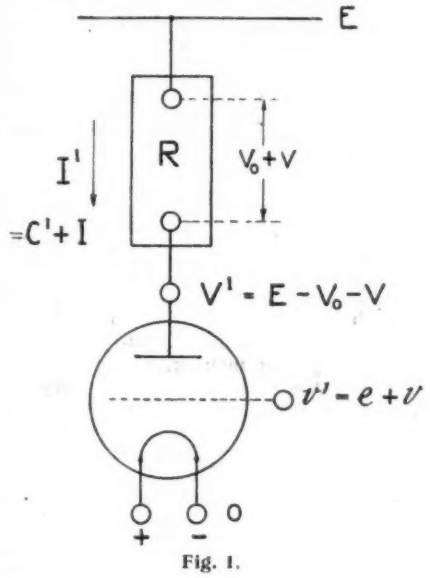


Fig. 1.

Then it will be clear that $V'=E-V_0-V$. Now the assumption that the family of anode current-grid potential characteristic curves of the valve is straight and parallel and proportionally spaced in the region utilised is equivalent to a linear characteristic equation for the valve in that region, of the form $I'=pv'+pV'+c$, where I', v' and V' are as already defined and p, q and c are constants. The meaning of this equation must be clearly understood: it is the intrinsic equation of the valve, an equation that is satisfied by the three variable quantities I', v' and V' at every instant of valve operation, irrespective of the nature of the external circuits. There is a limitation at extremely high frequencies due to electron speed lag, and a small error at very low frequency due to the passage of the anode current through a portion of the filament; also another slight effect negligible in small and medium sized valves used as amplifiers. None of these, however, affect the main argument.

It will be noted that since $dI'/dv'=p$ when V' is constant, and $dI'/dV'=q$ when v' is constant, p and q are, respectively, the mutual and anode (differential) conductances, whence $1/q$ is the "impedance." Now when $e=0$ then $V=0$; also $v'=e$ and $V'=E-V_0$, and $I'=C'$; therefore substituting in the characteristic intrinsic equation we have $C'=pe+q\ (E-V_0)+c$, but $I'=pv'+q\ V'+c$; subtracting and putting I for $I'-C'$ we have $I=pv-qV$ as the equation connecting I, v and V, the three superposed quantities, of which I and V are the result of the presence of v and only of that presence. If we rewrite the equation $V=p/q\times v-I/q$ we have the form from which the equivalent circuit rule is deducible. Suppose we had a generator of e.m.f. $p/q\times v$ (note that p/q is the amplification factor of the valve), and pure internal resistance $1/q$ (impedance of valve), and when we set it to work upon the anode circuit apparatus it produced a current I (all instantaneous values), there can be no doubt that the generator e.m.f. minus the p.d. lost in internal resistance would equal the operating voltage on the apparatus, *i.e.*, that $p/q\times v-I/q=V$, which is the same equation.

Again, it should be clearly understood that this is only the intrinsic equation of the generator, and is not soluble for the relations between v, V and I (three quantities) until we have another equation between them. Such other equation (between V and I) is derived from the characteristics of the apparatus itself. Thus the equivalent circuit rule is established and we may state it thus:—

Provided the family of anode current-grid potential curves of a valve are straight and parallel, and proportionally spaced *in the operating region*, those portions of the voltage and current effects in the anode circuit apparatus which are superposed upon and relative to the steady effects corresponding to steady grid bias potential, which themselves are a result of a superposed grid potential, are related to that superposed grid potential in precisely the same way as the corresponding voltage and current in a certain equivalent circuit are related to a certain e.m.f. in that circuit. The equivalent circuit contains a generator of e.m.f. amplification factor of valve multiplied by superposed grid potential, having a pure internal resistance equal to the "impedance" of the valve. It contains, as the imaginary "load" on the generator, the actual apparatus connected between the h.t. supply and the plate of the valve. Whatever effect this imaginary generator produces in this load, that is the superposed effect produced in the same apparatus by the action of the valve.

It is to be particularly noted that in the above consideration of valve function we are not in any way involved with the whole anode resistance. It is misleading to think of the valve as a variable total resistance, the actual resistance at any instant depending, not only upon the grid potential at that instant, but also upon the anode potential; that is to say, upon the nature of the anode circuit apparatus which is connected, whereas the "anode a.c. resistance," or "impedance," is dependent upon neither.

An interesting deduction from the above proof should be noticed: since $C'=pe+q\ (E-V_0)+c$ and $V_0=C'R$, therefore $C'\ (1+qR)=pe+qE+c$ or $C'=p\ +q\ E+c/(1+qR)$ and $\delta C'/\delta e=p/(1+qR)$, which is also $\delta I/\delta v$ for very slow changes of v, or when the anode "apparatus" is a pure resistance.

Picture Telegraphy.

At an informal meeting of the Institution of Electrical Engineers on November 26th, Mr. E. S. Ritter opened a discussion on "Picture Telegraphy," a title more comprehensive and accurate than "Photo-telegraphy," which, he said, was now an ordinary commercial process. Lantern slides illustrated the different forms of apparatus, their internal mechanism, and diagrams of connections; the Bell, Belin, Siemens-Carolus, Bart-Lane, and Marconi systems were some of those described and compared. Alternating current was generally used, as it was more easily transmitted over a telephone line, its frequency being chosen to suit the line characteristics. At present in all picture transmission some sharpness must be lost, and a photograph was reckoned to be critically sharp if the smallest dot did not exceed 5 mils in diameter. Mr. W. Cruickshank discussed the practical field for picture telegraphy, compared the speed of the Marconi system with that of the ordinary multiplex telegraph system, and pointed out that for sending symbols, diagrams, or special type, the picture telegraph was easily the best; it was being used in Japan and China for transmitting documents in the 4,000, or so, native characters that had no alphabet.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Sea-going Electricians.

On November 27th, Mr. Hardie asked the President of the Board of Trade whether his department was willing to consider the certification of sea-going electricians on the same lines as sea-going engineers.

Sir Philip Cunliffe-Lister said that on the information before him, he did not think that there were, at the present time, sufficient grounds for proposing legislation to compel ships to carry certificated electricians, in addition to the certificated engineers which they were already required to carry.

Hydro-electric Schemes.

On November 29th, Mr. Scrymgeour asked the Minister of Transport, in view of Parliament having soon to consider certain great hydro-electric schemes for Scotland, and seeing that Ireland, Canada, and Switzerland had undertaken and conducted such projects on the basis of national ownership, whether he would be prepared to so advise the Government on behalf of the people of Scotland.

Colonel W. Ashley said he did not at present propose to seek any powers to undertake and work hydro-electric schemes in Scotland. It had been the practice of Parliament to insert in Special Acts authorising such undertakings provisions that would enable them to be acquired by the State eventually.

Legal.

Commissioners of Inland Revenue v. British Insulated Cables, Ltd.

The reserved judgment in this appeal was delivered on November 30th, in the House of Lords by Lords Buckmaster, Sumner, Wrenbury, Carson, and Warrington, the point in dispute being whether, in consequence of its having statutory authority to supply electricity, the company was totally exempt from Corporation Profits Tax. The Special Income Tax Commissioners held that it was exempt, and Mr. Justice Rowlatt and the Court of Appeal upheld this finding, so the Commissioners of Inland Revenue appealed to the House of Lords, judgment being reserved on November 9th. Their Lordships now dismissed the appeal of the Commissioners.

Lord Buckmaster said that the company was a very large manufacturer of electric cables and electrical equipment, but by virtue of certain Provisional Orders, it was enabled to supply electrical energy within the urban district of Prescot for all public and private purposes, but was precluded from charging any higher price than that authorised by the Order. Although this part of its business formed only a small proportion of the whole, he considered that the exemption was not an exemption of a company in respect of that part of its business which consisted of the privileged undertakings, nor was it the exemption of a company whose undertaking was that of the special named industries. The exemption was, in plain words, an exemption from the provisions of Part V of the Act of a company that, in fact, carried on certain named undertakings. If it did that it was within the exemption of the sub-section; there was nothing to show that such undertaking must be exclusive; there was nothing to provide for the case of its being associated with other trades. The words of the exemption were plain and unmistakable, and they did not admit of the construction for which the Crown contended. It followed, therefore, that the appeal must be dismissed with costs. The other Law Lords concurred.

Commissioners of Inland Revenue v. Birmingham and District Power and Traction Co.

On the same day the House of Lords dismissed this appeal of the Commissioners against a decision of the Special Commissioners upheld by Mr. Justice Rowlatt. The company has a statutory tramway undertaking subject to restrictions, and therefore exempt from Corporation profits tax. It also, however, has three subsidiaries which operate motor omnibuses and are not subject to restrictions. The company claimed that its exemption from the tax extended to these undertakings, and its claim was allowed. The dismissal of the Commissioners' appeal confirms this decision.

"Liverpool" as a Trade Mark for Cables.

In the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Lawrence and Russell, on November 29th, the Registrar of Trade Marks appealed from the judgment of Mr. Justice Romer in the Chancery Division allowing two appeals by the Liverpool Electric Cable Co., Ltd., from a decision of the Assistant-Registrar of Trade Marks refusing to register the words "Liverpool Cables" as a mark distinguishing goods of the company's manufacture in both "A" and "B" classes.

The case for the respondent company was that the mark had become distinctive of their goods for the last two years, that they were well-known manufacturers of electric cables, and had used the description "Liverpool Cables" since 1901. The contention of the Registrar was that a town, when it became of sufficient importance, such as Liverpool, became more than a mere town name, and became part of the language, and if a person took the name of the town as a mark it was depriving other people of the use of it. He also contended that the use of geographical names as a trade mark was liable to cause confusion.

Mr. Justice Romer came to the conclusion that the words "Liverpool Cables" were now, and had for some time past been, capable of distinguishing the company's goods from those of the rest of the world. In those circumstances he did not think it was possible for the Court to say that the words were not "adapted to distinguish" the goods of the company to use the words of the 1905 Act. His conclusion was that the Assistant-Registrar's decision was erroneous, and the appeals would be allowed in both classes. From this result the Registrar now appealed.

The Attorney-General (Sir Thomas Inskip, K.C.) and Mr. Stafford Crossman appeared in support of the appeal; and Sir Duncan Kerly, K.C., and Mr. Trevor Watson for the respondent company. The Attorney-General said the Trade Marks Acts provided that, if the Registrar was not satisfied that the words sought to be registered were capable of distinguishing the goods of the applicant, he might refuse the application. The Registrar refused the application in this case on that ground. It was conceivable that there might be an amalgamation of the Liverpool Electric Cable Co. with some concern with the result that the cables might cease to be made in Liverpool, and yet it would then be the case that this firm would have a monopoly to describe the cables as "Liverpool Cables," notwithstanding that some other person might and perhaps did, manufacture cables in Liverpool and whose cables were Liverpool cables in fact. He contended that the Judge was not entitled on the evidence to say that the phrase "Liverpool Cables" had for some time served to distinguish the applicants' goods from those of other persons.

Sir Duncan Kerly, having supported the judgment of Mr. Justice Romer on behalf of the respondents, the hearing was adjourned.

At the conclusion of the arguments on November 30th the Court allowed the appeal.

The Master of the Rolls, in giving judgment, said that there was no doubt a considerable body of evidence on behalf of the applicants that the words "Liverpool Cables" had for a considerable time been applied to their goods, and had become known as distinctive of the cables manufactured by them. The applicants carried on business at Bootle, and they claimed that the words "Liverpool Cables" meant their goods and nothing else. Their contention therefore was that they had secured a secondary meaning to "Liverpool" so that the word meant their goods and no others, but having regard to the rights of the traders at large, and the people of Liverpool in particular, he thought the Registrar was quite right in holding that a word of that important significance ought not to be used or treated as a word capable of distinguishing the company's goods. In his opinion, Mr. Justice Romer's judgment should be set aside and the decision of the Registrar restored.

The other Lords Justices concurred, and the appeal was accordingly allowed with costs.

Greenock Corporation v. The Admiralty.

In the Court of Session, Edinburgh, on November 27th, the hearing was commenced of an action by the Greenock Corporation against the Admiralty for the payment of £250,670, with interest, since August, 1923. Plaintiffs aver that the principal sum sued for is due under an agreement made between them and the Admiralty, by which the latter bound itself to relieve the Corporation of the difference in costs as at the date during the war when expenditure was incurred in connection with the Greenock electricity undertaking, and August 31st, 1923. A very large development of the undertaking took place during the war owing to the greatly increased demand stimulated by war conditions among industrial undertakings, and in particular those engaged in the production of munitions. It became apparent that the extensions made to cope with the demand would become superfluous when normal conditions were resumed, and that the undertaking would be saddled with a large amount of unremunerative expenditure. Negotiations, therefore, took place with the Government with a view to the plaintiffs being relieved of a part of their responsibility for that large additional expenditure, and the result was the agreement mentioned.

Respondents deny liability. They maintain that no concluded agreement such as that alleged by the plaintiffs was entered into. They admit that the plaintiffs entered into negotiations with various Government Departments, and that a meeting took place at the Admiralty, but they say that the proposals never obtained the approval of the Board of Admiralty nor of the Treasury, and that, accordingly, if any agreement purporting to bind the Admiralty was arrived at,

it is not binding against the respondents, who further state that the present proceedings are excluded by the Indemnity Act, 1920. In any event, they say, the agreement, if made and if enforceable against them, relates only to capital expenditure upon plant installed by the plaintiffs for war purposes, and that the plaintiffs have no claim for expenditure otherwise incurred. They also contend that the date for comparing costs under the agreement should be November 11th, 1920, or December 14th, 1920, and not August 31st, 1923, as maintained by plaintiffs. They also maintain that the present demand for electricity from the plaintiffs is at least equal to that reached within two years of November or December, 1918.

The *Daily Telegraph* reports that a settlement was eventually reached. The terms were that the Admiralty was absolved from liability, no costs being awarded to either side, but it was understood that the Admiralty would make an *ex gratia* payment of £50,200.

A Vacuum Cleaner Dispute.

AT the Bradford County Court on November 27th the Electrical Distributors' Association, Ltd. (through Radio Vacuum Cleaners, Ltd., Bradford) claimed the price of a "Radio" cleaner from Mr. James E. Berwick, hotel proprietor, Bradford. It was stated that three women canvassers gave demonstrations of the cleaner at the defendant's hotel, but Berwick said the only thing he signed was, under much persuasion, an agreement to keep the machine for a month's trial, on a deposit of 10s., which was to be returned if he was not satisfied. At the end of the month he declined to buy the machine, and told the agent to take it and send his money back; the agent promised to send for it, and return the money. Instead, a summons came for the price of the machine. Berwick insisted that the signature on the order form was not his, but a very good imitation. He signed a piece of paper, and Judge MCCLEARY, comparing the two signatures, remarked that there certainly seemed a suggestion of two signatures, though either was a very good imitation of the other. The case was adjourned for plaintiffs to bring to Court the person who was alleged to have obtained defendant's signature to the order form. He ordered plaintiffs to pay the costs of the day's hearing.

False Trade Description.

IN our last issue we reported that Robert W. Coles, a traveller, had been remanded on a charge of passing off worthless articles as "Lissen" h.f. chokes. The defendant appeared again before the Lambeth magistrate on December 1st and, according to *The Times*, was further charged with obtaining money by false pretences. Prisoner stated that he bought the chokes believing them to be genuine, and his solicitor said that no evidence had been brought to show that he was concerned in their manufacture.

The magistrate said that he had not the least doubt that the prisoner knew the chokes to be spurious. He sentenced him to two months' imprisonment without hard labour on the first charge (brought under the Merchandise Marks Act) and to two months' imprisonment upon each of the charges of false pretences, the sentences to run concurrently.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Christmas Holidays.

We shall be glad if contributors and advertisers will take note that as the Christmas Holidays fall at an awkward time of the week for our printing arrangements it will be necessary to so alter our days of going to press that all news and other matter for the ELECTRICAL REVIEW editorial pages for December 21st and 28th must be in our hands earlier than usual.

An announcement by our Advertisement Department appears in our advertisement pages, and it is to the following effect:—

Copy and blocks for displayed advertisements to be received at 4, Ludgate Hill, E.C., not later than Wednesday, December 12th for December 21st issue, and Monday, December 17th for December 28th issue

Small classified advertisements can be received up to 5 p.m. on Monday, December 17th, for December 21st issue, and on Monday, December 24th, for December 28th issue.

Mr. Hoover and the American Electrical Industry.

In our issue of September 14th last, under the title "American Politics and Electricity," we quoted the comments of the *Electrical World* on the merits of the respective candidates for the Presidential Election. In a leaderette on November 23rd we wrote of Mr. Hoover as the Engineer President. Below we quote the editorial note with which the *Electrical World* heralded the election of Mr. Hoover:—

"Election over, the stock market has reflected by sharp advances in public utility stocks a sentiment prevailing among utility executives as well as in banking circles that Mr. Hoover's triumph in the national election augurs well for the electric public utility companies. It is a tribute to the industry to get such an endorsement, even though it be indirect; but the only assurance the utilities are justified in holding firmly is that any congressional legislation affecting them will be accepted or rejected by a President possessing toward utility problems a wise and an understanding heart. Any other interpretation of the election is unwarranted.

"It is wrong for any industry to attempt to cast its burdens upon the shoulders of Herbert Hoover, because he will have enough other and more important burdens to bear. It ought to be likewise apparent that, as President, Mr. Hoover cannot inaugurate or prevent any legislation by Congress favourable or inimical to public utilities. He will have, of course, the power of veto, which may or may not be effective. As an avowed champion of the cause of private initiative and enterprise, however, Mr. Hoover's influence will be potent with the body politic. The utilities have a great opportunity to buttress the faith of the country in the efficacy and superiority of private enterprise compared with government ownership and to render unwarranted any further legislative excursions into socialistic fields. The all-important task for them to set for themselves is to be ready to render the service which at this moment the nation most needs. The country has been set right in its thinking about the functions of government, so that the industry may devote itself wholly and unreservedly to its primary duty. This performed, it will merit and receive popular as well as presidential support and approval."

Prestatyn and the Sale of Appliances.

At last week's meeting of the Prestatyn Urban Council the Electricity Committee recommended that the Council should enter into an agreement with Metro-Vick Supplies, Ltd., for the sale of apparatus by the Council on the hire-purchase system. Objections were raised to the proposal by members of the Council, who maintained that there were tradespeople in the town who were capable of supplying electrical appliances. The matter was referred back to the Committee.

Some "Siemens" Films.

On several occasions we have commended the enterprise of electrical manufacturers in producing kinema films showing their works and productions, for we consider that there are few more popular and effective publicity methods. The latest departure in this direction has been taken by SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD. Last week London representatives of the electrical industry and the Press were invited to a *première* of some films which the company has made of its various activities. Batteries were the subject of the first two films, the processes from the manufacture of the elements, through assembly, to dispatch being shown in an interesting manner which enabled the audience to understand thoroughly how things were done. Then there came a picture of automatic telephone manufacture, a rather more difficult subject, which, however, was adequately treated to convey some idea of the work. The succeeding film dealt with a more familiar subject—the production of telephone cables. The scene then shifted from Woolwich to Preston to show the intricate business of lamp-making. The thing that impressed the audience most was the dexterity and speed of the girl operatives. These films are to make a tour of the company's various branches, where they will be exhibited to members of the trade, to technical societies, &c., during the next twelve months.

D

The Factory Lighting Campaign.

In spite of the inclement weather over 330 people attended a demonstration at the new switchgear works of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park on November 22nd. The visitors were entertained in the staff canteen by the company, when Mr. J. S. Peck, a director, extended a welcome to them. Later, Mr. R. C. Hawkins gave a lecture dealing with the economics of modern factory lighting, which was illustrated by many demonstrations and figures showing actual installations. At the conclusion of the lecture Mr. L. Romero, the chairman of the Manchester and District Circle, proposed a vote of thanks to the Metropolitan-Vickers Co. for its hospitality, and this was seconded by Mr. C. H. Rayner. The lecture was actually held in one bay of the new works which has recently been completed. The installation consists of 30 1,000-W lamps in concentrating reflectors, mounted 40 ft. from the floor, and 92 500-W lamps in angle

The New Met.-Vick. Switchgear Works.

reflectors, mounted 16 ft. from the floor. The average intensity in the works is about 9 foot-candles, and the installation forms a striking example of the correct use of electric light for industrial purposes, as will be seen from the accompanying illustration. The new building is 420 ft. long and 220 ft. wide, and the walls are of steel structure filled and faced with brick. The roof is multiple pitched with the north sides glazed. The building is provided with ten cranes, fire prevention sprinklers on the Mather & Platt system, and the Plenum system of air heating and ventilating. It is equipped for the assembly and testing of the largest switchgear units of both metal-clad and outdoor types, required for the British "Grid" and other super-power schemes, in connection with which the company has large contracts in hand. The company's present programme includes the development of switchgear up to 230,000 V and units up to two million kVA breaking capacity. A 500,000-V transformer equipment for test purposes has been installed.

An address by Mr. J. L. H. Cooper on the "Economic Advantage of Good Factory Illumination," was given at a meeting on November 29th of the Midland Branch of the National Union of Manufacturers, held at the Chamber of Commerce, Birmingham. The chair was taken by Mr. H. D. Jackson, chairman of the Midland Council, who, in introducing the lecturer, said that his council had been considering the effect of lighting in factories upon industrial fatigue, accidents, and production.

Mr. Cooper, in the course of his address, said that industrial illumination was a subject of prime importance, not only to the manufacturer and the worker, but to the country in general because it had been definitely ascertained that good lighting was no longer a burden on industry, but on the contrary, was linked up with industrial efficiency. Apart from increased production, the reduction of accidents and the provision of better working conditions were aspects well worth considering. Correct illumination could be readily obtained if the recommendations of lighting engineers were adhered to; it was most essential that the modern gasfilled lamp should be employed in modern equipment. A lighting scheme was available for every type of building and trade. The lecture was accompanied by demonstrations and illustrated by lantern slides showing the results of tests made in well-lighted factories where the increase in production varied from 12 to 25 per cent. Special reference was made to the "hidden losses" due to industrial accidents and from this score alone good lighting was well worth considering.

A Birmingham correspondent reports that the Campaign is already bearing good fruit in the Birmingham district, several large orders for factory lighting installations having been placed with local firms during the past few days. This, happening at a time when little money is being spent by private firms on developments of this character, is attributed to the vigour with which the Campaign has been conducted locally, and in particular to the factory lighting demonstration which was held at the Birmingham Corporation's showrooms during November.

New Italian Companies.

Among the concerns recently formed in connection with the electrical industry in Italy are La Società Fabbrica Italiana Conduttori Elettrici E. Lancellotti, Naples, capital 100,000 lire; and La Società Apparecchiatura e Impianti Elettrotrazione, Milan, capital 1,000,000 lire.

Great Britain's Radio Exports.

Statistics published in the current *Wireless Trader* show that during September radio apparatus valued at £80,870 (valves £12,834) was exported from this country. Australia took the largest share of this—£12,248, including valves £3,121. Italy with £11,059 (valves £18) was second, and other important customers were Sweden, £8,860 (valves £1,152), the Netherlands, £7,678 (valves £182), the United States, £2,968 (valves £1,032), France, £2,553 (valves £192), Argentina, £2,483 (valves £7) and Jugo-Slavia, £2,186.

Recent Contracts.

The General Electric Co., Ltd., has received an order from the Manchester Corporation tramways for thirty 500-V tramcar motors, each of 50 h.p., on the one-hour rating, together with sixty controllers. An order for six tramcar electrical equipments, each equipment including two 500-V motors of 41 h.p. on the one-hour rating, has also been placed with the company by the Walthamstow Tramways.

The lamp contracts recently received by the company include twelve months' supplies of vacuum and gasfilled lamps and vacuum train lighting lamps for the Great Western Railway, and a three months' contract for vacuum and gasfilled lamps and Robertson carbon filament lamps for the Air Ministry.

The Pekin-Mukden Railway Company has ordered an "E.L.1" type of electric arc-welding plant from the Equipment and Engineering Co., Ltd.

Although the matter is not strictly of electrical interest, it is worth recording that the Southern Railway Company has placed an order for 5,000 tons of steel sleepers for its track. This is the first order of the kind to be placed by a British railway company, and if the steel sleeper were generally adopted the steel industry would derive considerable benefit.

The Electrical Contractors' Association.

The annual dinner of the Electrical Contractors' Association is to be held at the Savoy Hotel, London, on January 22nd. The 1929 annual conference is to be at Bournemouth on June 26th, 27th and 28th.

At a recent meeting of the Council of the Allied Associations a resolution was passed to the effect that as from May 1st, 1929, no member of the N.E.C.T.A., Ltd., should deal with any wholesaler or factor (not being a specially-appointed agent for the goods in question) who was not approved by the Council as coming within the definition of the Trading Policy of the Association.

Proposed Co-ordination of London Traffic.

At Tuesday's meeting of the London County Council the Highways Committee asked the Council to approve the London County Council (Co-ordination of Passenger Traffic) Bill, 1929. This Bill seeks to enable the Council to enter into agreements with the Underground Electric Railways Co. of London, Ltd., and others, with regard to the passenger transport undertakings owned by them, embodying the principles of common management and a common fund subject to suitable protective supervision. The Bill deals in detail with the proposed agreements, the application of the common fund, the appointment of an advisory board, the compensation of displaced employés, &c.

The British Chamber of Commerce, Paris.

A great deal of very useful work on behalf of British trade and British interests generally is carried out by the British Chamber of Commerce, Paris. We are therefore interested to hear that the Chamber is endeavouring to increase its influence by raising its membership. The figure is at present 1,400, and the Chamber aims at a membership of 2,000. The objects of the Chamber can be heartily commended to those of our readers who conduct business in or with France. Membership carries with it participation in a business intelligence service of no mean order and many other forms of assistance. The Secretary is Mr. J. Butler, and the offices of the Chamber are at 6, Rue Halévy (Place de l'Opéra), Paris, IXe.

Dundee and Foreign Cables.

A long discussion took place at a meeting of Dundee Electricity Committee last week with regard to the acceptance of offers for the supply of cable. The lowest foreign offer was £1,945, as against the lowest British offer of £2,286, a difference of about 18 per cent. In moving that the British offer be accepted, a member said that the fetish of cheapness seemed to be taking possession of the British people in an

extraordinary way. Another member, who recently visited the Continent, said that the wages paid in Antwerp to men in the electrical trades amounted to 35s. per week, whereas the British figure was about £4. By seven votes to three the Committee decided to recommend the acceptance of the foreign offer, but that before the meeting of the Town Council an effort should be made to secure a reduction in the British offer.

Publicity for the National Register.

In order to bring the objects of the National Register of Electrical Installation Contractors more forcefully before the general public the Executive Committee has decided to issue a leaflet explaining in simple language the risks which are inseparable from installations put in by unqualified contractors; the way to avoid these risks; and how to tell who is a registered contractor. This leaflet can be supplied to registered contractors at cost in minimum lots of 500 at 12s. 6d. per five hundred and £1 3s. per thousand. In view of the peculiar attitude of the daily Press on some electrical matters, it is significant that the *Daily Mail* recently published a short article drawing attention to the work of the National Register. This has aroused considerable interest, and inquiries have reached the offices of the Register from all parts of the country.

Italian Lamp Production.

The output of electric incandescent lamps in Italy during the five months ended with May last reached a total of 6,545,663, as compared with 6,372,286 in the corresponding period of 1927.

Calendars and Diaries.

Mr. G. BARNARD (selling agent for Tarmac, Ltd.), 1, Nile Street, Birmingham, has sent us a neat table calendar with a magnetic date-marking device, bearing an advertisement of "Vinculum" electrical concrete.

The 1929 calendar of the D.P. BATTERY CO., LTD., bears, as usual, a pleasing view of the Derbyshire country in which the company's works are situated. It also has neat monthly date slips.

We have received a set of 1929 cards to refill the calendar of the BRITISH INSULATED CABLES, LTD.

A diary containing a great deal of information in concise form has reached us from Mr. CHARLES SELZ, 47-49, New Cavendish Street, W.1.

We have received from the ASSOCIATION OF ENGINEERING AND SHIPBUILDING DRAUGHTSMEN its diary for 1929. This contains the usual wealth of technical and general information, and is strongly bound.

The Cardiff Engineering Exhibition.

In the notes on this exhibition in our last issue we inadvertently stated that a boiler-scaling process evolved by the NEW OSCILLOSCOPE CO., LTD., was electrolytic. While it is electrical, it is definitely *non-electrolytic*.

For Sale.

Mr. H. J. Shaw will sell by auction on December 12th, at 13, High Holborn, W.C., various stocks of wireless accessories, components, &c. (See our advertisement pages to-day.)

A New Battery Showcard.

We illustrate herewith a showcard recently produced by the D.P. BATTERY CO., LTD. It comprises a main centre-piece

A New "D.P." Showcard.

with two hinged panels in which are well-coloured pictures indicating the various applications of "Kathanode" batteries.

Unemployment.

The registers of the Employment Exchanges showed an increase of 16,240 in the number of unemployed during the week ended November 19th. The total at that date was 1,364,400, as compared with 1,348,160 on November 12th, and 1,126,250 on November 21st, 1927.

Local Exhibitions.

CLACTON.—An electrical exhibition arranged by the Clacton Electricity Department (engineer: Mr. George Broadhurst) was held at the Clacton Band Pavilion, from November 19th to 24th. There were 17 stands, and a number of national electrical manufacturers exhibited, as well as several local firms. The Electric Lamp Manufacturers' Association arranged a lighting demonstration room, in which modern illumination methods were demonstrated. Berry's Electric (1928), Ltd.,

A "Magicoal" Display at Clacton.

had a good show of "Magicoal" fires, which is illustrated herewith. Other exhibitors were the Credenda Conduits Co., Ltd. (cookers, fires, &c.), Belling & Co. (fires, water heaters, &c.), the British Electric Transformer Co., Ltd. ("Sun-Ray" radiators, cookers, &c.), the General Electric Co., Ltd. ("Magnet" washer, vacuum cleaners, fires, cookers and fittings), the Hotpoint Electric Appliance Co., Ltd. (fires, washing machine, &c., and cooking demonstrations), Sadia, Ltd. (water-heating apparatus), the Revo Electric Co., Ltd. (cookers and fires), Siemens Electric Lamps & Supplies, Ltd. (cookers and other domestic appliances), and Electrolux, Ltd. (refrigerator, vacuum cleaners and floor polishers). The local exhibitors were: Messrs. F. W. Lewellen, Ltd., Davison & Garrod, the Universal Lighting Co., and F. Malby & Co. The exhibition was well attended and, with the aid of the attractive tariff which is in force, should prove a strong stimulant to domestic electrical development in the town.

BLACKPOOL.—An electrical exhibition organised by Blackpool Electricity Department, was opened by the Mayor on Saturday last. There were 50 stands. A feature was a wireless section with a representative show of the latest apparatus. The British Thomson-Houston Co., Ltd., had a good display of lighting fittings of all kinds—domestic, industrial, and commercial. In addition the company had an attractive "Mazda" lamp display in one of the miniature shop windows which faced the approach. There was also an exhibit of "Hotpoint" fires, vacuum cleaners, and other domestic appliances.

"Metro-Vick" Lighting Fittings.

The latest catalogue issued by METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is one of the most beautiful productions of its kind which we have seen. Its 362 pages cover practically every kind of lighting fitting made, from the classic to the ultra-modern, and each item is illustrated in a way which shows to the best advantage the excellence of the design and workmanship. A frontispiece illustrates in colour a selection of ten art finishes from the many which can be applied to the fittings, and here and there throughout the catalogue there appear views of the company's showrooms and actual installations of "Metro-Vick" lighting fittings. At the end of the volume there are indexes and useful notes on lamps, &c. As will be gathered from this description, the catalogue cannot be broadcast; only *bona-fide* applicants can be given a copy.

New Catalogues and Lists.

THE WHOLESALE FITTINGS CO., LTD., 23, Commercial Street, E.1.—Supplement No. 221, containing a large number of illustrations of glassware lighting fittings. Priced.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A circular giving details and prices of the company's decorative lamp outfits.

THE BUDA COMPANY, ENGLAND, Cecil Chambers, Strand, W.C.2.—A pamphlet illustrating and advertising "Buda-M.A.N.-Diesel" generating sets, from 50 to 100 kW d.c., and from 62 to 120 kVA a.c.

MESSRS. FREDERICK THOMAS & CO., LTD., 189 & 191, Drummond Street, N.W.1.—Two illustrated price lists dealing, respectively, with alabaster bowl fittings and "Efteelite" totally-enclosed lighting glassware.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—An illustrated pamphlet drawing attention to the company's pre-twisted shaped conductor cables.

The UNDERFEED STOKER CO., LTD., Africa House, Kingsway, W.C.2.—A handsome brochure describing the company's "Type L" stoker. The construction and operation are fully detailed and illustrated, views of actual installations being included.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—An illustrated pamphlet dealing with a new "M. & C." face-belt conveyor driving gear for electrical or pneumatic operation.

MESSRS. ISENTHAL & CO., LTD., Victoria Road, Acton, W.3.—A well-illustrated catalogue of rheostats and resistances for laboratory, test-room and industrial purposes. Priced.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—Catalogue No. 207, containing a specification and numerous illustrations of the company's induction motors. Also a blotter advertising these.

MESSRS. RAINSFORD & LYNES, LTD., Emily Street, Birmingham.—List No. 23, a series of illustrated and priced leaflets giving details of the company's switch- and fuse-gear.

December calendar-blotters have been received from Messrs. ARTHUR LING & CO., LTD., 138, Fetter Lane, E.C.4, POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2, and Messrs. S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1.

THE MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Denmark Street, W.C.2.—A poster suggesting suitable "Mullard" valves for various "constructional" receiving sets.

SUPERLAMP, LTD., 92 & 94, Paul Street, E.C.2.—An illustrated catalogue of radio sets and apparatus, and a net trade price list of electrical material, including cables, conduits, switchgear, &c.

MESSRS. GEORGE H. SCHOLES & CO., LTD., Blantyre Street, Hulme, Manchester.—An illustrated publication containing full details of "Wylex" switch-plugs, two-piece cable glands, and the "Sanco" joint box.

MESSRS. WARREN BROS. (MIDDLESBROUGH), LTD., Grange Road, Middlesbrough.—An illustrated pamphlet and a blotter advertising Howard's patent separator.

THE HEWITTIC ELECTRIC CO., LTD., Hersham, Surrey.—Publications Nos. 105 and 106, describing, with illustrations, the construction and operation of the company's mercury arc rectifiers.

HIGGS MOTORS, Witton, Birmingham.—A sectional catalogue containing fully illustrated particulars and prices of the various types of electric motors made by the firm. Particulars of an extended guarantee are given. Also a reprint of an article dealing with the manufacture of Higgs motors.

DOMESTIC ELECTRIFICATION, LTD., Townsend House, Greycoat Place, S.W.1.—A leaflet illustrating and describing the "Type R.C.F." electric fire.

"M.K." ELECTRIC, LTD., Wakefield Street, Edmonton, N.18.—A series of illustrated and priced pamphlets dealing with "M.K." switch plugs, plugs and sockets, switch plates, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—Pamphlet L.452, illustrating and describing the company's ceiling and wall attachments for the easy changing of lighting fittings in showrooms, &c.

A G.E.C. Exhibit.

The accompanying illustration depicts the stand arranged by the GENERAL ELECTRIC CO., LTD., at the recent Ironmongery, Hardware and Domestic Appliances Exhibition, held at the

A G.E.C. Exhibition Stand.

Agricultural Hall, London. The display comprised numerous examples of the company's lighting fittings, as well as "Magnet" cooking, heating and labour-saving appliances.

Social Events.

The first dance at the new Royal Horticultural Hall was given by the Mullard Wireless Service Co., Ltd., on November 23rd. Of the 2,000 guests, 1,500 were members of the Mullard staff, and many well-known public men were present, including the Mayor of Battersea, Lt.-Col. Moore-Brabazon, M.C., M.P., Sir Alfred Butt, and Sir Henry Jackson, M.P. A presentation of a gold wristlet watch and a set of cuff links was made by the staff to Mr. S. R. Mullard, whilst Mrs. Mullard was presented with two bouquets.

Over 1,000 persons attended a recent whist drive at Blackpool Electricity and Tramway Employés' Institute, and over 2,000 were present at a subsequent dance. The Mayor and Mayoress, Alderman and Mrs. Potter, distributed the prizes.

Exports Credits Insurance.

The Exports Credit Guarantee Department of the Department of Overseas Trade, 9, Clements Lane, Lombard Street, E.C.4, has published a booklet, "An Explanation of the Facilities Provided by H.M. Government for Insuring and Financing Credits for Exports." This deals very concisely with the history and operation of the scheme and the means by which traders can avail themselves of this valuable aid in their attacks on foreign markets. It will be remembered that Parliament recently authorised an extension of the period within which grants might be given to September 8th, 1931, and the period to which the guarantees remaining might remain in force up to September 8th, 1936.

Christmas Gift Suggestions.

The SUN ELECTRICAL CO., LTD., has issued to the trade an attractive folder containing many suggestions for Christmas gifts, mainly domestic electrical appliances and radio apparatus. It is well illustrated and prices are given.

Book Notices.

"Definitions and Formulæ for Students." "Electrical," by P. Kemp, pp. 37; price 6d. net; "Heat Engines," by A. Rimmer, pp. 32, price 6d. net. London: Sir Isaac Pitman and Sons.

"Wave Mechanics and the New Quantum Theory." By A. Haas. Pp. xviii+124; illustrated. London: Constable & Co., Ltd. Price 7s. 6d. net.

"Life and Work of Sir Norman Lockyer," by T. M. and W. L. Lockyer. Pp. xii+474; figs. 16. London: Macmillan and Co., Ltd. Price 18s. net.

Bankruptcy Proceedings.

H. S. STEPHENS and S. WEILL, trading as Stephens & Weill, wholesale accessories merchants, 55, Great Eastern Street, E.C.—This firm failed on August 27th, and on November 27th the debtor Weill applied to Mr. Registrar Mellor at the London Bankruptcy Court for an order of discharge. Mr. D. Williams, Official Receiver, reported that the provable debts amounted to £36,770; the firm's assets, valued at £1,487, had realised £1,208; a further £16 might be received, and a dividend of 4½d. in the £ would probably be paid. Their commencing capital of £137 was provided by Stephens, while Weill was insolvent by approximately £1,000. The debtors attributed their failure to bad debts; to losses by selling goods slightly under cost; to excessive drawings from their business, and to losses occasioned by having financed certain German manufacturers. Their trading loss of £24,657 sustained in 1925 was entirely attributable to the failure of a German manufacturer, to whom they had advanced £25,000 by means of their acceptances. The Official Receiver, in opposing the application, reported that the debtor's assets were not of a value equal to 10s. in the £; that he had omitted to keep proper books of account; that he had continued to trade with knowledge of insolvency; that he had contributed to his bankruptcy by unjustifiable extravagance in living; and that in obtaining possession of and dealing in hypothecated goods and certain moneys he had been guilty of fraud and grave misconduct as a trader. The trustee also opposed the application, and intimated that he desired to add to the allegations made by the Official Receiver, and Mr. White, for the debtor, desired an opportunity to challenge the Official Receiver's charge of fraud and grave misconduct. His Honour accordingly adjourned the application until December 10th. In reply to the Registrar, Mr. Williams said an order of discharge had already been granted to the debtor Stephens, he not being a party to the transactions in respect of which fraud and misconduct were reported.

W. P. HODGE, wireless salesman, late of 62, Cannon Street, E.C., residing at 46, St. Leonards Road, Exeter.—An application was made on November 30th to Mr. Registrar Francke at the London Bankruptcy Court for an order of discharge on behalf of this bankrupt, who failed in September, 1927. The Official Receiver reported that the provable claims amounted to £3,065; the assets had realised £125, and a dividend of 2d. in the £ would probably be paid. The bankrupt was a Baptist minister at Exeter, receiving an average annual stipend of about £300. From October, 1924, to February, 1925, he acted as a director of Betts, Sons & Browning, Ltd., wireless and electrical merchants, and from November, 1925, to November, 1926, he worked for that company on commission. He then, until the date of the receiving order, acted as managing salesman for another firm in the trade. The insolvency was attributed to loss of money invested in underwriting schemes, and to heavy interest on borrowed money. The application was opposed by the Official Receiver on various statutory grounds, including rash and hazardous speculations, and the discharge was suspended for two years.

S. J. SEWELL and W. L. BROWN, trading as Sewell & Brown, 6a, The Exchange, Muswell Hill, N., electrical and radio

engineers.—These debtors petitioned the London Bankruptcy Court on May 16th last, and an application for an order of discharge was made on November 27th to Mr. Registrar Mellor by the debtor Brown. The Official Receiver reported that the provable debts amounted to £997; the assets, valued at £357, had realised £146, and a dividend of 1s. 8d. in the £ would be declared. The failure was attributed to insufficiency of profits to meet overhead charges and partners' drawings through lack of capital and trade depression. The discharge was suspended for six months on statutory grounds.

T. S. S. SOUTHWOOD, Hunston, near Chichester, electrical engineer.—The public examination herein was held on November 21st, at the Court House, Brighton, when a statement of affairs was produced showing liabilities of £418, against assets estimated to realise £171. The debtor attributed his failure to losses on contracts and jobbing works, in consequence of inexperience in estimating, &c. The examination was adjourned for closing.

R. YEEND, 19, Victoria Avenue, Lynn Road, Wisbech, Cambridge, electrician.—The first meeting of creditors was held recently at the Official Receiver's office, Cambridge. According to the statement of affairs there were liabilities of £438, against assets of £94, leaving a deficiency of £344. Debtor attributed his failure to becoming liable for the debts of a partner and to over-stocking before the slump. The case was left in the hands of the Official Receiver as trustee.

G. COHEN, electrical engineer, 49, Newman Street, Oxford Street, W.—Trustee, Mr. S. P. Child, 36 & 37, Queen Street, E.C., appointed November 22nd, 1928.

H. H. SPEKE, electrician, 12-17, Bilston Street, Wolverhampton.—Last day for proofs for dividend, December 11th. Trustee, Mr. F. E. Bendall, 3, Warwick Passage, Corporation Street, Birmingham.

B. H. WISHAW, electrical and wireless engineer, Bakewell Road, Matlock.—Receiving order made November 28th, on debtor's own petition.

G. S. HALL (G. S. Hall & Co.), electrical engineer, late of 8, Malden Road, New Malden, Surrey.—Bankrupt's discharge was suspended on November 2nd for four weeks expiring November 30th, 1928.

J. GLICKMAN (Manchester Radio Service Co.), wireless factor, 10, 12 & 14, Great Ducie Street, Strangeways, Manchester.—Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, released November 6th, 1928.

H. REES, works electrician, 67, Clase Road, Morriston, Swansea.—Trustee, Mr. H. Rees, Official Receiver, Government Buildings, St. Mary Street, Swansea, released November 21st, 1928.

N. H. WOOD, electrical engineer, late of 38, St. Charles Square, N. Kensington.—Last day for proofs for dividend, December 15th. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.

Company Liquidations.

THOMAS GUNN, LTD., general ironmongers and electricians, Fore Street, E.C., and branches.—We are informed by one of the joint liquidators of this company, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., that a second and final dividend of 2s. 4d. in the £ has now been declared and paid to all creditors, making a total distribution of 6s. 4d. in the £.

WEDMORE ELECTRIC LIGHT & POWER CO., LTD.—A meeting of creditors is called for December 10th, at the offices of Messrs. Christy Bros. & Co., Ltd., Broomfield Road, Chelmsford, by the liquidator, Mr. A. A. Gates. (This notice is formal; all creditors will be paid in full.

ELECTRICAL CONTRACTS & MAINTENANCE CO., LTD.—First and final dividend of 2s. 5½d. in the £, payable at Carey Street, W.C.

Dissolution of Partnership.

SIDNEY HATHAWAY & Co., factors in wireless accessories, 397, Poolstock Lane, Wigan, and Bold Place, Liverpool.—Mr. S. F. Hathaway and Mr. G. F. Taylor have dissolved partnership. Mr. Hathaway will attend to debts.

Private Arrangements.

R. G. MANLOVE, 695, London Road, Westcliff-on-Sea, Essex, wireless dealer, &c.—A meeting of creditors was held on November 29th, at the offices of Messrs. Matthews Wiseman and Co., 70, Victoria Street, S.W.1, when Mr. P. Houston, of the British Traders' Association, was elected to the chair. The statement of affairs submitted showed ranking liabilities of £640, and, in addition, there were fully secured creditors for £2,290, holding security valued at £2,456. The assets were estimated to realise £1,087, leaving a surplus of £447. It was reported that debtor entered into a partnership in a business carried on under the style of "Kingstons" at Westcliff, introducing £454. Later the debtor took over the business, agreeing to pay his outgoing partner a sum of £250, and had since traded alone. The debtor had put into the business sums aggregating £1,060, and he had only drawn out £53. The debtor had been endeavouring to sell the business as a going concern, and it was hoped that a sale would be effected, enabling him to pay all liabilities and have a surplus. It was decided that a deed of inspectorship should be executed to Mr. E. H. Hawkins, 4, Charterhouse Square, E.C. A committee of three of the principal creditors was also appointed.

Trade Announcements.

MR. W. R. AMOS, electrical and radio engineer, of Stratford-on-Avon, has removed to 37, Wood Street.

Messrs. WATLIFF & Co., electrical engineers, of 87, Cambridge Road, Kilburn, W.C., will on December 10th remove to their new factory at 175, Merton Road, Wimbledon, S.W.19. Telephone No.: "Wimbledon 5299."

Messrs. ALEX. TURNBULL & Co., LTD., Bishopbriggs, Glasgow, have appointed agents in London, Manchester, and Birmingham for their steam fittings.

The HIGHFIELD ELECTRICAL CO., LTD., has removed to "Faraday Works," Stoney Stanton Road, Coventry. (Telephone: Coventry 2970.)

Messrs. J. F. & G. HARRIS, LTD., general timber merchants and moulding manufacturers, will remove their offices, &c., on November 12th to 23, Clifton Street, E.C.2. Telephone: Bishopsgate 7010.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, December 4th: No change in the price of electrolytic copper.

Messrs. James & Shakespeare report, December 4th: No change in the prices of copper bars (best selected) sheet and rod. English pig lead, £23, 10s. inc.

Messrs. Edward Till & Co. report, December 4th: India-rubber, Para fine, 10¾d., ¼d. inc.

Messrs. James Forster & Co., reporting on December 1st, stated that a rise in lead prices which occurred last week was probably due more to sympathy with advancing prices of spelter than to any alteration in the general position of lead itself. A better demand was experienced from Germany for Russian account, but this would hardly justify the rather abnormal advance. So far as this country is concerned, supplies are plentiful while consumptive demand is very quiet and likely to remain so for the next few weeks.

Lighting and Power Notes.

Birmingham.—ELECTRICITY SUPPLY.—At a meeting of the Corporation Electricity Supply Committee on November 28th, it was reported that whereas the rate of increase in the sales of electricity had slowed down during August and September an improvement had taken place during the past few weeks, and the daily returns now showed an average increase of 10 per cent. over last year's figures. The final details with regard to the assisted wiring scheme had been completed, and full particulars would be published in the course of a few days.

The continued progress of the undertaking is indicated by the fact that 1,585 additional premises were coupled up to the mains during the month of October. These additional connections represent some 23,000 lamps in lighting and 5,200 h.p. in power supplies.

Bradfield.—PRICE REDUCTION.—The Whitchurch and Pangbourne Electric Supply Co., Ltd., has informed the Rural District Council that the charge for electricity for lighting will be reduced from 1s. to 10d. per kWh in the New Year.

Brazil.—HYDRO-ELECTRIC DEVELOPMENT.—It has been decided to increase the capacity of the power plants supplying the districts of Barretos, Bebedouro, Jaboticabal and the Araraquarense zone by utilising part of the power of the Marimbondo Falls, capable of generating 300,000 h.p. Electricity will be brought to Olympia and distributed thence to the various companies forming part of the Central Electrica de Icem, a combination of several smaller electricity companies at Barretos, Jaboticabal, Taquaritinga, Jahú, Araraquara and Ribeirao Preto. These have now been incorporated in the Empresas Electricas Brazileiras, which has contracted with the General Electric Company for all the necessary electrical material, and with the I. P. Morris Company for the hydraulic material. The initial installation will be capable of utilising 20,000 h.p., of which 10,000 h.p. has been already harnessed. The total energy controlled will be 50,000 h.p., of which 35,000 h.p. will be supplied to 67 municipalities with a total population of 1,209,700.—*Reuter's Trade Service* (San Paulo).

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Shawinigan Water & Power Co., Ltd., has recently put into operation in its power house No. 2 at Shawinigan Falls another 45,000 h.p. unit. The installation of a further unit of the same size is to be completed early next year. The productive capacity of the system is approaching 700,000 h.p., and plans are being formulated for the development of large additional amounts of power on another stretch of the St. Maurice River.

Clyde Valley.—ELECTRICITY CHARGES.—The Clyde Valley Electrical Power Co. has issued a circular replying to criticisms of its revised electricity charges. It is pointed out that under either the two-rate tariff or the rental tariff, provided the consumer's bill reaches £1 13s. 4d. per annum (or other agreed charge) the maximum charge for electricity metered is 5d. per kWh for shops and 4½d. per kWh for houses. Under the rental tariff, as now adjusted, the minimum rental is reduced from £3 to £1 per annum, quarterly rental is no longer payable in advance, where the maximum charge per kWh over the year was 6d. it is now reduced to 4½d. for

houses and 5d. for shops, and the charge for electricity as metered is reduced (in all but 6 of 85 towns and villages) from ¾d. to ½d. per kWh.

Cheltenham.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the borrowing of £39,562 for mains, transformers, and switchgear.

Colwyn Bay.—LOAN.—The Urban District Council has applied for sanction to a loan of £4,000 for erecting a transformer sub-station and providing an underground cable at Mochdre, and an overhead system for Llangystenin.

Continental.—SWEDEN.—The total production of electrical energy in Sweden during the past year increased by about 10 per cent., and amounted to 4,385 million kWh, of which one-third was generated by Government power plants. The gross revenue from electricity sold during 1927 amounted to nearly 120 million kronor. Of the power used for special purposes there was an increase of 25 per cent. for railways and tramways, 16 per cent. for lighting, domestic and agricultural use, and 13 per cent. for the big industries, electrolytic and smelting purposes.

GERMANY.—The development of hydro-electric power in Germany continues to make good progress. Concessions have recently been granted for three new plants; one near Chemnitz, another in Baden for supplying power to the South German railways, and a third in the Ruhr district. The three plants will together develop more than 500,000 h.p.

SPAIN.—Work has recently been completed on the erection of a new steam-operated power station at Seo de Urgel in the province of Lerida for the Sociedad Co-operativa de Fluido Electrico. Two 7,000-h.p. turbo-generators have been installed, but when fully completed the station will have three sets, giving a total of 21,000 h.p. The power generated is being transmitted at 110,000 V, a distance of about 75 miles to the Barcelona industrial area. The plant is the first in Spain to use the low-grade fuel of the country.

ITALY.—A message from Reggio Emilia to Il Sole says that the Italian Minister for Public Works has recently inaugurated one of the largest hydro-electric plants in Italy at the Farneta power station, in the commune of Montefiorino, Modena. The plant, which has been constructed for the Emilian Land Development Consortium for its own draining works and farmers on the land reclaimed, derives its power from the upper reaches of the tributaries of the Secchia—the Dolo and Dragone. The station's eight turbines will be capable at present of an annual output of 75,000,000 kWh, but when the Dragone Falls are utilised at Mischioso, the annual production will amount to 100,000,000 kWh. The plant has cost 80,000,000 lire to construct.—*Reuter's Trade Service* (Milan).

Exeter.—LOAN.—The City Council is making application for sanction to a loan of £37,500 for plant extensions at the generating station.

Finchley.—LOANS.—The Urban District Council Electricity Committee has received sanction to the borrowing of £18,000 for mains and services.

A letter has been received from the Electricity Commissioners stating that they are prepared to sanction a loan of £10,580 for a new boiler, but having regard to the probable developments under the South-East England scheme as affecting the Council's undertaking, they are not disposed to allow a longer period than seven years for the loan. The electrical engineer is to interview the Commissioners with regard to the loan period.

Glasgow.—CHANGE OF FREQUENCY.—The Corporation Special Sub-Committee on Purchase of Plant, &c., Central Scotland Electricity Scheme, 1927, having considered in consultation with the district engineer of the Central Electricity Board the purchase of plant and appliances required in connection with the change of frequency, has approved the following works: Dalmarnock generating station: Extension of 20,000-V switchboard, £18,027; double tiering of 20,000-V switchboard, £20,071.

PROGRESS DURING OCTOBER.—Under the Corporation Electricity Department's scheme 574 houses were wired in October, making the total to date 9,962, while the number of applications for hire of appliances was 721, bringing the total to 21,169.

SWITCH PANELS.—The Electricity Committee has approved the manager's proposal that six skeleton switch panels be installed at Dalmarnock power station for future requirements, at a cost of £1,025.

MAINS EXTENSIONS.—The Committee has recommended that distributing mains be laid, at a cost of approximately £18,000.

Guildford.—LOAN.—The Corporation Electricity Committee is to apply for sanction to a loan of £2,000 for the purchase of meters.

MAINS EXTENSIONS.—The Committee is to extend mains to supply Clandon House, Temple Court, and the Woking Road district, at a cost of £2,110.

Lincolnshire.—BOSTON RURAL DEVELOPMENT.—The Boston and District Electric Supply Co., Ltd., whose original Order covered some 50 square miles, has now with its 1928 Extension Order and Holbeach Electricity Special Order an area of 270 square miles in the County of Holland (Lincolnshire). At the moment over 12,000 yards of distributors have been laid in the Holbeach area which, although an urban district, is rural in character, and an 11,000-volt, 3-phase, 50-period, transmission line is in course of erection between the Mount Bridge power station, Boston, and the main sub-station at Holbeach. Delay in obtaining compulsory wayleaves is considerably delaying the work on this line, but it is hoped that electricity will be available in the Holbeach district early in March, 1929. Provided that a further application for compulsory wayleaves is settled promptly, a further transmission line between Holbeach and Sutton Bridge will be put in hand immediately on completion of the Boston-Holbeach line; the second line will serve the urban districts of Long Sutton and Sutton Bridge, and a number of villages in the East Elloe rural district. The consent of local and county authorities to the erection of 18,000 yards of low-voltage overhead distributors for village electrification has already been received. In the northern part of the area a 3,000-volt line is being run from Kirton to Sutterton, and a further line route from Sutterton to Swineshead *via* the villages of Wigtoft and Bicker is now being surveyed. In the rural areas the company is installing four free lights, complete with lamps and shades, together with a free service, and no extra charge per kWh is being made to the consumer. The company also has in force hire-purchase and assisted-wiring schemes, and it also hires cookers at 2s. 6d. and 5s. per quarter. In the whole of the area, in addition to the usual flat rates, there is a two-part tariff with a secondary charge of 1½d. per kWh in the northern portion of the area and 2d. per kWh in the southern portion; it is hoped, however, to reduce the charge in the southern area. Steps are now being taken to form a Rural Electric Development Association in the area, members of which will comprise representatives of the local branches of the National Farmers' Union and various local and county authorities.

Littlehampton.—STREET LIGHTING.—The Urban District Council has entered into a new contract for public lighting with the Sussex Electricity Supply Co., Ltd., at a charge of 5½d. per kWh, to include maintenance. The previous contract was approximately 3½d. per kWh.

London.—BATTERSEA.—The Borough Council Electricity Committee has received sanction to the extension of the generating station by the addition of one 30,000-kW turbo-alternator, two 65,000-lb. boilers, and two 125,000-lb. boilers and the necessary additions to buildings.

The Committee has voted £1,343 for services to 132 premises, £1,535 for mains extensions, and £1,505 for replacement with armoured cable of old vulcanised bitumen distributors.

POPLAR. — The Borough Council Electricity Committee has agreed to extend mains, &c., at a cost of £2,750 to provide a further supply of electricity for the Port of London Authority at West India Docks.

Sanction has been received to the borrowing of £149,000 for plant, and £42,530 for extensions to mains and converting plant.

HAMMERSMITH.—The Borough Council Electricity Committee has recommended extensions to mains in various parts of the borough, at an estimated cost of £3,039.

Milton Regis.—ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council a letter was read from Messrs. E. Lloyd, Ltd., offering to supply electricity to the district, and a similar offer was received from the Weald Electricity Supply Co. A committee was appointed to meet the other local authorities concerned in the matter.

Morecambe.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to a loan of £11,000 for mains.

New Zealand.—LAKE COLERIDGE.—The report on the Lake Coleridge hydro-electric undertaking for the year ended March 31st last shows a total revenue of £71,127, and working expenses of £40,054, leaving a gross profit of £31,073. After providing for interest and depreciation there was a net surplus of £25,880, as compared with £10 in the preceding year. The output of electricity increased from 78,342,797 to 93,853,759 kWh, and the maximum supply demanded from 16,850 to 21,020 kW. The capacity of the plant is 27,000 kW, and an order for an additional 7,500-kW set has been placed. A 12,000-kVA bank of transformers was installed at the Addington sub-station (which serves Christchurch) during the year.

WAIKATO (HORAHORA).—The accounts of the Horahora undertaking for the year ended March 31st last show a total income of £125,312, and after deducting working expenses (£46,568), interest (£44,190), depreciation (£18,616), and sinking fund charges (£9,732), there remained a net surplus of £6,176, as compared with £17,116 in 1926-27. The sales of electrical energy increased from 75,844,229 to 87,852,067 kWh, and the maximum supply demanded from 14,760 to 15,700 kW. At the Penrose sub-station, which supplies the Auckland Power Board, the plant installed includes three 5,000-kVA transformers, three 1,667-kVA transformers, and one 10,000-kVA synchronous condenser with three 3,333-kVA transformers.

MANGAHAO.—The report on the Mangahao undertaking records a total income of £44,112, from which the following charges had to be met: Working expenses, £33,914; interest, £106,441; depreciation, £35,301. There was therefore a net loss of £131,544. The electrical energy sold increased from 73,842,017 to 97,786,572 kWh, and the maximum supply demanded from 18,100 to 20,040 kW.

According to the *Electrical Engineer of Australia and New Zealand* the report of the Public Works Department states that the main dam of the Arapuni scheme was completed in December last, and the concrete foundations for the three

15,000-kW units which will form the initial installation were completed. The report also states that there are now 43 power boards constituted in New Zealand, the total area covered being 66,903 sq. miles, and the population served 929,763. The total number of public supply undertakings was 41, and the installed plant capacity increased during the year from 138,915 to 146,360 kW, of which hydro-electric plants accounted for 78 per cent.

Settle.—ELECTRICITY SUPPLY.—The Rural District Council has approved a draft Special Order for a supply of electricity (excepting Ingleton and Thornton-in-Lonsdale) to be carried out by Crompton Parkinson, Ltd. The maximum charges are to be: For the winter quarters—12s. 6d. for the first 15 kWh per quarter, and 10d. per kWh for additional supplies. Summer quarters—8s. 4d. for the first 15 kWh per quarter, and 10d. per kWh for energy in excess of this amount.

Turkey.—ELECTRICAL DEVELOPMENT.—In order to provide for the increasing demand, the Société Turque d'Electricité is about to extend its central station at Silighdar, Constantinople. A new battery of four high-pressure steam boilers and a 2,700-kW turbo-generator are to be installed, and at the same time the low-pressure section of a 10,000-kW turbo-generator is to be converted to high-pressure. A 10,000-V transmission line is also being erected from the power station to the banks of the Bosphorus.

Tynemouth.—ELECTRIC WATER HEATING.—At a recent meeting of the Corporation Electricity Committee the electrical engineer submitted a report with regard to water heating. He recommended that electricity should be supplied for this purpose at 0.6d. per kWh in the summer and ¾d. per kWh in the winter, arrangements being made to cut the supply off during the heavy load periods. The Committee adopted the recommendation.

Ulverston.—INQUIRY.—Colonel F. Gordon Tucker recently held a Ministry of Transport inquiry relative to the objections of the Rural District Council to the proposed route for an overhead transmission line from Cark Viaduct to Grange-over-Sands and Meathop, in connection with an electricity supply scheme promoted by the Barrow-in-Furness Town Council. The Town Clerk of Barrow said that the Corporation received some time ago an application for a supply of electricity to the sanatorium at Meathop, and the only economic way of giving that supply was by overhead lines, and he submitted that this was the only practical route. Another point was that by this proposed line the Corporation would have an alternative route for the existing supply to Grange-over-Sands. It was intimated that the Grange Urban District Council had decided to support the application. The opposition was on the ground that the overhead lines would be detrimental to the amenities of the district.

Wickford. — APPLICATION TO COMMISSIONERS. — Application has been made by the Wickford and District Electricity Supply Co., Ltd., to the Electricity Commissioners for consent to establish a generating station under the company's Special Order, 1923, at Stileman's Works, Wickford.

Witham.—INAUGURATION OF SUPPLY.—The East Anglian Electric Supply Co., Ltd., on November 26th entertained the Witham councillors to luncheon on the occasion of the inauguration of the supply of electricity to the town. This extension of the system completes one more link in the chain of overhead lines erected by the company for the purpose of completing its rural scheme of electricity supply in the Essex area.

Tramway and Railway Notes.

Canada.—ELECTRIC RAILWAYS.—The electric railways of Canada last year carried 32,687,358 more passengers than in 1926. A recently-issued report shows that a total of 781,398,194 passengers were carried in 1927 on the 2,528 miles of electric railways in the Dominion. The gross revenue of these railways last year was $53,506,401, an increase of $1,993,038 over that of the previous year.

Glasgow.—INQUIRY.—The Electricity Commissioners have replied to the protest of the Corporation against the appointment by the Commissioners of their chief electrical engineer as chairman at the inquiry to be held with regard to the proposed extension of the plant at the Pinkston power station. They state that the chief engineer will conduct the inquiry impartially and give his report on the evidence submitted to him. It is understood that the inquiry will be held in Glasgow on December 19th.

London.—UNDERGROUND STATION IMPROVEMENTS.—A new subway, 190 ft. in length, is to be driven at Tottenham Court Road tube station, so that passengers may reach as well as leave the Hampstead line platforms at the south end. This will relieve the congestion which now occurs during busy hours at the north end of the station.

The reconstruction of the frontage of Mansion House Station (District Railway), which is now complete, is to be followed immediately by improvements to the booking hall which will increase the traffic circulating area by one-third. The booking office is to be demolished and the site utilised for a cloak room and an office for the issue of season tickets. Automatic ticket-printing-and-issuing machines will also be installed. There will be 12 of these machines. A further improvement will be the construction of a new entrance to the subway leading to the westbound platform.

The work of installing the twin escalators at Camden Town Station on the Hampstead Line, which was commenced in August, is progressing rapidly, and, roughly, one-third of the new tunnels has been completed. It is expected that the escalators will be ready for traffic by April of next year. When these are completed work will be commenced on the construction of four new subways, each 75 ft. in length, which will lead to the Hampstead and Highgate line platforms. The two escalators will be capable of handling 10,000 passengers an hour, as compared with 1,000 passengers by the three lifts now used. Camden Town will be the 29th station to be equipped with escalators. At present there are 70 escalators in service, excluding the 11 shortly to commence work at the Piccadilly Circus new station. The company's latest programme provides for 87 escalators at 34 stations.

BREAKDOWN.—The fusing of a cable in Acton Vale caused a breakdown in the London United and L.C.C. tramway services east of Horn Lane, Acton, on December 3rd, at 5.15 p.m. A complete service was not resumed until 7.10 p.m.

Maidstone.—RAILLESS CARS.—The Transport Committee has recommended to the Town Council, in view of the satisfactory results of railless cars on the Barming route, that a similar service be substituted for electric tramcars on the Loose service, and petrol vehicles for the service to Tovil.

Northern Ireland.—BELFAST.—The Corporation tramcars are being reconstructed and modernised. They are to have improved electrical equipment, giving greater horse-power, and quicker acceleration and retardation.

Southend-on-Sea.—PROVISIONAL ORDER.—The Corporation has applied to the Minister of Transport for permission to introduce a railless-car service between the junction of High Street with Victoria Circus and the junction of Marine Parade with Southchurch Avenue.

Sunderland.—LIGHT RAILWAY EXTENSION.—The Corporation is to apply to the Minister of Transport for an Order under the Light Railways Acts, authorising it to construct a railway in Durham Road.

Telegraph and Telephone Notes.

Austria.—RADIO-TELEGRAPHY.—The Austrian branch of Marconi's Wireless Telegraph Co., Ltd., inaugurated a direct radio-telegraph service to Egypt on December 1st.

Radio-telegraphy.—IRISH CHANNEL STATION.—The Post Office authorities are taking steps to establish a wireless-telegraph station at Fleetwood to operate when communication by means of submarine cable either with the Isle of Man, or Ireland, is interrupted.

Railway Telephony.—LARGE P.A.B.X.—The Southern Railway Co.'s private branch automatic telephone exchange, installed some three years ago with a hundred Post Office public exchange lines, is already proving insufficient to deal with the increasing ramifications of railway traffic radiating from Waterloo Station, London. Plans are under consideration for further extensions of the system, involving a possible expenditure of £100,000, says the *Evening News*. More than 3,000 calls an hour are dealt with during the peak periods, and the operators are capable of dealing with 150 calls per minute. Approximately 2,000 stations are in direct touch with headquarters over the company's 850 private lines. From this telephone exchange are sent out each day Greenwich time signals to all stations. Some 59,000 public calls, made from the company's four kiosks at Waterloo, are dealt with monthly. Telegraph messages are handled, goods deliveries in all parts of the country are dealt with; general inquiries and questions as to times of trains, &c., are answered. The company has its own private telephone directory.

Turkey.—TELEPHONY.—Discussions have been proceeding for some time past between the Turkish Government and the German Siemens group with regard to the establishment of inter-urban telephone communication in Anatolia. It appears that for financial reasons the Government wishes to make the undertaking a form of concession, whereas the German group is said only to desire to act as a contractor. In the meantime the Swedish Ericsson Company has come forward with proposals which are now being examined.

Radio Beacons.—NEW STATIONS.—The wireless beacon built at Start Point, Devon, by Marconi's Wireless Telegraph Co., Ltd., for the Corporation of Trinity House, has just been completed. It is the seventh of its kind now established round the British coasts at Round Island, Skerries, Spurn Lightship, The Casquets (Channel Islands), Start Point, Bar Lightship,

Albatross (Coningbeg, Ireland), and in the near future further beacon stations of the Marconi type will be installed at Sule Skerry (Scotland), Lundy North, Dungeness, Kinnaird Head (Scotland), Cromer, South Bishop, and other places, in addition to similar stations for which orders have been received in other parts of the world. The completion of the Start Point transmitter means that very effective cross bearings can now be taken by ships using the three Channel stations; the beacons in the British Isles have a power of 500 watts and operate on a wave-length of 1,000 metres, which is the specified length for beacon stations, and the whole equipment is automatically controlled by a master clock for transmitting groups of interrupted-continuous-wave signals at pre-arranged intervals. The call sign of the Start Point station is GSM and accurate direction finding bearings may be expected up to about 100 nautical miles under normal atmospheric conditions. A rotating-loop beacon is being erected by the Air Ministry at Orford Ness, Suffolk, which will use a wave-length of 1,000 metres. Accurate readings have been obtained on aircraft from this type of beacon up to 200 miles.

Radio Notes.

France.—PHOTO-TELEGRAPHY.—Tests of picture transmission on the Bélin system are being carried out by Radio-Toulouse broadcasting station. From January, 1929, a picture service will be linked with broadcast opera, says *World-Radio*, for the station intends to transmit photographs of the artistes taking part in operas relayed from the Theatre du Capitole.

Sweden.—NEW STATION.—About Christmas time the Malmö station will be replaced by a new one at Hörby in Skane, having a power of 20 kW.

United States.—TELEVISION.—A committee appointed by the Radio Manufacturers' Association of the United States has recommended that all "radiovision" pictures at present being broadcast be standardised, so that one receiver with one scanning disk will be able to receive any of them. The committee's standard is the system used by Mr. C. F. Jenkins in Washington. The method recommended uses 48 lines with 15 separate pictures (frames) every second. The pictures therefore will not show much detail, being decidedly inferior in this respect to the pictures which Mr. J. L. Baird can broadcast from his laboratory, says *Nature*. It is expected that all the television broadcast stations in the United States will adopt this standard.

WIRED-WIRELESS.—An interesting transaction, foreshadowing the lines on which broadcast radio-telephony in the United States is expected to develop, is reported from New York: by a deal involving a large transfer of patents the North American Company, one of the largest suppliers of electric light and power in the United States, has granted the Kolster Radio Corporation title to no less than 600 of its patents, in return for exclusive licences in the field of wired-radio to one of its subsidiaries, Wired Radio Inc. The patents concerned include the fundamental patent for "chain broadcasting," as well as patents for television and talking motion pictures. The significance of the transaction is the fact that within the coming decade most of the broadcasting in the United States will, it is predicted, be carried on over household electric light and power wires, the air being left clear for commercial and safety communications; in this way the worst of broadcasting difficulties will be overcome. The Kolster Radio Corporation has also received from the North American Co. a contract to manufacture for Wired Radio Inc. not less than one-third of its apparatus requirements, the value of the business which it will receive in this way being estimated at approximately £7,200,000 per annum. The North American Co. is already fully equipped to enter the wired-radio field.

Loud-speakers.—"NUISANCE" BY-LAW.—The General Purposes Committee of the Westminster City Council, having inquired of the Home Office whether any by-laws had been sanctioned regarding nuisances caused by the installation of wireless loud speakers, was informed that a by-law had been allowed under Section 23 of the Municipal Corporations Act, 1882, to a few boroughs. The nuisance arising from the use of such instruments in private houses, it was added, was not, in the opinion of the Home Secretary, one which could be made the subject of a by-law. The committee recommends the City Council to make a by-law prohibiting the use of a wireless loud-speaker so as to cause annoyance in any public place, shop, or business premises, under a penalty not exceeding £5. A by-law dealing with the matter was recently made by the East Ham Council.

Portable Receivers.—LICENCE PROBLEM.—The possibility that numbers of owners of wireless sets are at present quite innocently defrauding the Government will be brought before the notice of Parliament next week. In recent Bristol police court proceedings it appears that a solicitor, prosecuting on behalf of the General Post Office, stated that in the case of a portable wireless set, two licences were necessary, one being compulsory for the home stations and another for travelling. In the circumstances of a person going on holiday, however, permission could be obtained from the Post Office for the set to be taken to the temporary address of the owner for as long a period as a month.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia. — MELBOURNE. — January 8th. Department of Posts and Telegraphs. Switching equipment and relays. (B.X. 4880.);* fuses, heat coils, and arrestors (B.X. 4881.)*

January 15th. Telephone transformers. (B.X. 4878.)* Coil posts. (B.X. 4879.)*

January 22nd. Telephonists' telephones. (B.X. 4888.)* Telephone transmitters and parts. (B.X. 4889.)* Telephone receivers and parts. (B.X. 4890.)*

January 29th. Accumulator batteries and counter e.m.f. cells. (B.X. 4906.)*

January 16th. Victorian Railway Commissioners. Rotary convertor or rectifier set for Glen Waverley sub-station. (B.X. 4893.)*

February 4th. State Electricity Commission of Victoria. 11,000-V switchgear for Yallourn Power Station. (B.X. 4897.)* 11,000-V and 22,000-V switchgear and accessories for Richmond. (B.X. 4898 and 4901.)*

January 14th. 11,000-V transformers and spares. (B.X. 4900.)*

February 4th. Pillar insulators with metal parts, for use on 132,000-V outdoor circuits. (B.X. 4921.)*

Ayr.—Tramways Department. General stores for the year to December 31st, 1929. Forms of tender, &c., from Mr. W. Grant, tramway manager, Town Buildings, Ayr.

Barnoldswick.—December 15th. Urban District Council. Complete electricity distribution scheme. (November 23rd.)

Belgium.—BRUSSELS.—December 13th. Société Nationale des Chemins de Fer Belges. Armoured and unarmoured cables. (B.X. 4930.)*

Blackpool.—December 14th. Electricity Department. E.h.p., h.p., and l.p. paper-insulated cables, service boxes and cut-outs. (See this issue.)

Bromley (Kent).—December 12th. Borough Council. Electrical wiring of 91 houses on the Southborough housing site. (November 30th.)

Dublin.—December 10th. Electricity Department. E.h.p. switchgear and accessories. (November 16th.)

Edinburgh. — December 11th. Education Authority. Electrical installation for the new Leith secondary school. Specifications from Messrs. Reid & Forbes, architects, 7, Ainslie Place, Edinburgh.

December 18th. District Board of Control. Lancashire boilers, economisers and engineering plant required for Gogarburn. Specifications to the architect, Mr. Stewart Kaye, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—January 24th. Ministry of the Interior. Installation of an electrical system at Beba. (B.X. 4916.)*

Glasgow.—December 10th. Corporation. Electric lighting installation at Scotstoun and Gairbread housing schemes. Specifications, &c., from general manager, 75, Waterloo Street.

London.—CENTRAL ELECTRICITY BOARD.—January 4th, 1929. 132,000-V transformers in connection with the South-East England Electricity Scheme, 1927. (November 2nd.)

December 17th. Central Scotland Electricity Scheme. Oil filtering and storage equipment for 13 outdoor transforming stations. (November 30th.)

ISLINGTON.—January 2nd. Electricity Department. E.h.p. switchgear and accessories. (November 23rd.)

January 18th. One 5,000-kVA and one 375-kVA or one 750-kVA Scott connected transformers. (November 23rd.)

Manchester.—December 11th. Tramways Committee. Steel girder tramway rails. Specification from secretary, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand. — WELLINGTON. — February 12th. Public Works Department. 110-kV switchgear and controlling equipment for Waitaki electric power scheme. (B.X. 4848.)*

March 5th. Seven 5,500-kVA single-phase transformers. (B.X. 4873.)*

January 15th. Posts and Telegraph Department. Telephone cords. (B.X. 4847.)*

December 10th. Two-conductor cords. (B.X. 4929.)*

January 15th. Vitreous enamel phase-indicating plates. (B.X. 4927.)*

Preston. — December 12th. Electricity Committee. 60,000 tons of fuel for Ribble power station, Penwortham, during 12 months ending December 31st, 1929. Specification from Mr. J. F. Simpson, borough electrical engineer.

Prestwich.—County Mental Hospital. Steam and electrical cooking apparatus, &c. (November 30th.)

South Africa. — JOHANNESBURG — January 10th. South African Railways and Harbours. Five electrically-driven traversers and one 5-ton hand-operated overhead travelling crane. (A. 7170.)*

December 20th. Telegraph material, poles, insulator, wires, &c. (A.X. 7223.)*

GRAHAMSTOWN.—January 22nd. Municipal Council. Cables, transmission lines and transformers. (B.X. 4913.)* Centrifugal pumps, motors and cable. (A.X. 7187.)*

PRETORIA.—January 24th. Posts and Telegraphs Department. Telephone switchboards. (B.X. 4912.)*

Southend.—December 31st. Light Railways and Electricity Department. 3,000 joint boxes. (November 30th.)

Stafford.—December 28th. Education Committee. Installation of electric light and power in the County Mining College, Cannock. (See this issue.)

Stockton-on-Tees.—December 10th. Electricity Department. Supply of paper insulated cables. (November 30th.)

Stoke-on-Trent.—January 16th. Electricity Department. L.p. d.c. switchboard; e.h.p. ironclad switchgear. (See this issue.)

Stretford.—December 11th. Urban District Council. Three 10,000-kVA three-phase transformers. (November 23rd.)

Turkey.—ANGORA.—December 18th. Post, Telegraphs and Telephones Department. 50,000 metres of rubber-covered field-telephone wire. (B.X. 4849.)*

CONSTANTINOPLE.—January 5th. Posts, Telephones and Telegraphs Department. 60,000 porcelain insulators and 15,000 swan neck fittings.—(B.X. 4904.)*

Wakefield.—December 19th. West Riding Education Committee. Installation of electric lighting at Wath Secondary School. Specifications from Education Department, County Hall, Wakefield.

Watford.—Board of Guardians. Electric light installations at the casual, mental and infirmary block. Particulars from Mr. F. Wilson, clerk, 7, Church Street.

Woking.—December 10th. Surrey County Council. Electrical wiring and fittings for the Brookwood Mental Hospital reception block. Mr. E. Lancaster Burne, engineer, 28, Victoria Street, Westminster (returnable deposit of £3 3s.).

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bedford.—Watch Committee. Recommended:—
Electric traffic signals (£179) at St. Peter's and (£141) at St. Mary's.—Barber & Colman, Ltd.

Dover.—Town Council. Accepted :—
Feeder cable (£1,798).—Pirelli-General Cable Works, Ltd.

Easthourne.—Town Council. Accepted :—
Illumination of showrooms and main offices (£364).—General Electric Co., Ltd.

Erith.—Urban Council. Accepted :—
Cables for the Woolwich Road extension (£2,192).—Callender's Cable & Construction Co., Ltd.

Glasgow.—Tramways Committee. Recommended :—
Axles, wheels, and tires for reconditioned cars.—J. Baker and Co. (Rotherham, 1920), Ltd.
Gearing for destination screens for reconditioned cars.—W. C. Yuille & Co., Ltd.
Switchboard for new 'bus garage.—Edison Swan Electric Co., Ltd.
Transformer.—Ferranti, Ltd.
Vacuum cleaning plant for Govan depôt.—Barr & Co.
Electricity Committee. Recommended :—
220 yards lead-covered cable for Dalmarnock Power Station.—W. T. Glover & Co., Ltd. (£135).

Gravesend.—Health Committee. Recommended :—
Wiring the Sanatorium for electricity.—Sidney & Freed.

Grimsby.—Electricity Committee. Recommended:—
E.h.p. switchgear (£3,550).—Metropolitan-Vickers Electrical Co., Ltd.

Leeds.—Electricity Committee. Accepted :—
Cables.—(£1,595), W. T. Henley's Telegraph Works Co., Ltd.; (£1,704), Enfield Cable Works, Ltd.; (£1,890), Macintosh Cable Co., Ltd.; (£1,587), Greenwich Cable Works, Ltd.; and (£1,680), Hackbridge Cable Co., Ltd.
Circulating water pipes and valves (£3,258).—W. H. Allen, Sons & Co., Ltd.

London. — WESTMINSTER.—Housing Committee. Recommended :—
Installation of electric lighting at entrances, staircases and laundries at Regency Street dwellings :—

BUCHANAN & CURWEN. (Recommended.)	£579
Coleby & Co.	655
H. E. Keen & Co., Ltd.	699
Gaillard, Robinson & Co.	748
Drake & Gorham, Ltd.	765
Rashleigh Phipps & Co., Ltd.	768
Speedy & Eynon	978

Manchester.—Electricity Committee. Accepted :—
Replacement of cells in Dickinson Street battery.—Tudor Accumulator Co., Ltd.
Cable work, Barton Station extensions.—Callender's Cable and Construction Co., Ltd.
Waterworks Committee. Accepted :—
Transformers, rotary convertors, switchgear, &c., for Lostock booster station, and four motor-driven centrifugal pumps, switchgear, &c.—Mather & Platt, Ltd.
Watch Committee. Accepted :—
Electric traffic control signals.—Barber & Colman.
Tramways Committee. Accepted :—
Copper and cadmium copper trolley wire.—R. Johnson and Nephew, Ltd.
Steel tramway poles.—British Mannesmann Tube Co., Ltd.
Tramway pole sleeves.—Bromford Tube Co., Ltd.

Oldham.—Electricity Committee. Accepted :—
Electric lift at showrooms.—Etchells, Congdon & Muir, Ltd.

Salford.—Electricity Committee. Recommended :—
Erection of two 6,600-V brickwork cubicles for controlling two auxiliary transformers at Agecroft power station (£1,594).—Metropolitan-Vickers Electrical Co., Ltd.

Sheffield.—Electricity Committee. Accepted :—
Four 500-kVA sets of Scott transformers (£1,280).—British Electric Transformer Co., Ltd.
Switchgear (£745).—A. Reyrolle & Co., Ltd.
Cooling tower for Neepsend generating station (£3,040).—Davenport Engineering Co., Ltd.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, December 7th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "The Application of Electro-deposited Metals to Engineering." Mr. C. H. Faris.

Nottingham Society of Engineers.—Friday, December 7th. Victoria Station Hotel. 7.30 p.m. Annual dinner.

Junior Institution of Engineers.—Friday, December 7th. Royal Society of Arts, Adelphi, W.C. 7.30 p.m. Address by the President, Lt.-Col. J. T. C. Moore-Brabazon, M.P.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 8th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Bulk Handling of Coal and Ore." Mr. H. K. Broughton.

(Western Sub-Branch).—Saturday, December 15th. 60, Wind Street, Swansea. "Some Electrical Tests." Mr. E. W. Davies.

Institute of Marine Engineers.—Saturday, December 8th. Institute, Minories, E. 7 to 11 p.m. Social and dance. Tuesday, December 11th. 6.30 p.m. "Practical Refrigeration for Ships." Mr. A. Greenfield.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, December 10th. Institution, London, W.C. 7 p.m. "Power Factor Tariffs and Methods of Metering." Mr. E. W. Dorey.

Irish Centre (Dublin).—Thursday, December 13th. Trinity College, Dublin. 7.45 p.m. "Commercial Problems Relating to the Applications of Electricity from the Shannon Distribution Scheme." Mr. P. A. Spalding.

(Mersey and North Wales (Liverpool) Centre).—Monday, December 10th. University, Liverpool. 7 p.m. "Transatlantic Radio-Telephony." Mr. E. H. Shaughnessy.

(North-Eastern Centre).—Monday, December 10th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "An Introduction to Researches on Circuit Breaking." Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce (Electrical Research Association Report).

(North Midland Centre).—Tuesday, December 11th. Hotel Metropole, Leeds. 7 p.m. "Short-Circuits in Large Power Systems." Mr. W. W. E. French.

(North-Western Centre).—Tuesday, December 11th. Engineers' Club, Manchester. 7 p.m. "Tariffs." Mr. L. Romero.

Friday, December 14th.—College of Technology, Manchester. 7.30 p.m. Faraday lecture. "How Electricity Does Things." Mr. Ll. B. Atkinson.

(Scottish Centre).—Tuesday, December 11th. North British Station Hotel, Edinburgh. 7 p.m. "The Electrification of the Pietermaritzburg-Glencoe Section of the South African Railways." Mr. F. Lydall.

(Western Centre).—Monday, December 10th. South Wales Institute of Engineers, Cardiff. "Overhead Electric Lines." Mr. W. B. Woodhouse.

(Dundee Sub-Centre).—Thursday, December 13th. University College, Dundee. 7.30 p.m. "Radio Receivers: Design, Practice and Tendencies in 1928-29." Mr. H. K. Hunter.

(North-Eastern Centre, Students' Section).—Friday, December 7th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Industrial Electric Heating." Mr. G. H. Bowden.

(London Students' Section).—Friday, December 14th. Institution, London, W.C. 6.15 p.m. "The Applications of Electricity in the Printing Industry." Mr. T. H. Lockett.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, December 11th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "The Operation of Modern Transformers." Mr. S. A. Stigant.

(West Yorkshire Section).—Saturday, December 8th. Great Northern Hotel, Wellington Street, Leeds. 5.30 for 6 p.m. Annual dinner.

Illuminating Engineering Society.—Tuesday, December 11th. Lighting Service Bureau, 15, Savoy Street, W.C. 6.30 p.m. "The Use of Electric Light for Advertising Purposes." Mr. H. Lingard.

Institution of Engineers-in-Charge.—Wednesday, December 12th. St. Bride Institute, E.C.4. 7.30 p.m. "Central Heating Systems." Mr. W. E. Fretwell.

Royal Society of Arts.—Wednesday, December 12th. John Street, Adelphi, W.C. 8 p.m. "Applications of Electricity to Medical Practice." Mr. G. G. Blake.

British Institute of Radiology, incorporated with the Röntgen Society.—Thursday, December 13th. 32, Welbeck Street, W.1. 8.30 p.m. Ordinary meeting.

Polytechnic Engineering Society.—Friday, December 14th. Polytechnic, Regent Street, W. 7.30 p.m. Annual conversazione.

Physical Society.—Friday, December 14th. Imperial College of Science, South Kensington, S.W. 5 p.m. "A Survey of Heat." Dr. E. Griffiths, F.R.S.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Otta bowl fires.

Midgard adjustable extending lamp brackets.

Electric flashers having the appearance of a small ebonite disk which fits inside the lampholder.

Notes.

The Electrical Engineers' Ball, 1929.

It has been arranged to hold the Electrical Engineers' Ball on February 8th, 1929, at the Hotel Cecil. Below we give, as usual, a list of members of the General and Executive Committees and officers:—

General Committee—

Alabaster, H.
Alabaster, G. H.
Allcock, H.
Andrews, L.
Atkinson, Ll. B.
Baidwin, O. H.
Balfour, G., M.P.
Bowden, J. H.
Callender, Sir T. O., J.P.
Chattock, R. A.
Cramb, A. C.
Crawter, F. W.
Cridge, A. J.
Couzens, H. W.
Elder, T. C.
Ferranti, Dr. S. Z. de
Fox, E. J.
Gatehouse, E. A.
Gill, F., O.B.E.
Gillespie, M. M.
Gray, James
Gregory, J. P.
Gridley, Sir A., K.B.E.
Hadley, A. E., C.B.E.
Hardie, Lt.-Col. C., D.S.O.
Highfield, J. S.
Hill, C. W.
Hirst, Sir H., Bt.
Hunter, P. V., C.B.E.
Hughman, R. W.
Kerr, M. J. D.
Kingsbury, J. E.
Kolle, H. W.
Lackie, W. W., C.B.E.
Leaf, H. M.
Leigh, Lt.-Col. F. A. Cortez
Lonsdale, W. S.
Macgregor, J. J., C.B.E.
McKinstry, A. E.
Mackay, H. J. S.
McClelland, Wm., C.B.
McMahon, P. V.
Mason, A. V.
Matthews, W. Lee
Midgley, H. E.
Mordey, W. M.
Moss, E. W.
Nalder, F. H.
Nash, Sir P., K.C.M.G., C.B.
New, E. S.
Noble, Sir W.
Page, A.
Partridge, G. W.
Pearce, Dr. S. L., C.B.E.
Pooley, F.
Purves, Col. T. F., O.B.E.
Railing, M. J.
Riley, G. E.
Rinder, A. S.
Rogers, F. M.
Rowell, P. F.
Russell, Dr. A.
Sayer, C. E.
Scholey, H., C.B.E.
Siddeley, H. C.
Sillar, A. M.
Sinclair, D. J.
Snell, Sir J., G.B.E.
Sutton, Sir G., Bt.
Taite, C. D.
Taylor, G. M. C.
Trezise, J. M. G.
Walton, A. H.
Wilson, D.
Woodhouse, W. B.
Worsdell, F. E.

Executive Committee—

O. H. Baldwin.
H. W. Couzens.
A. C. Cramb.
C. W. Hill.
J. E. Kingsbury.
W. S. Lonsdale.
P. V. McMahon.
A. M. Sillar.
A. H. Walton.

Hon. Secretaries—

A. M. Sillar. C. W. Hill.

Hon. Treasurer—J. E. Kingsbury.

Transactions of the Fuel Conference.

The *Transactions* of the Fuel Conference (World Power Conference), held in London recently, including 167 papers, reports of discussions, and Sectional Summaries, will consist of some 4,500 pages, in three volumes and an index volume; they are to be published early next year, and up to December 31st orders can be placed at a reduced price with the publishers, Messrs. Percy Lund, Humphries & Co., Ltd.

Industrial Accident Prevention.

"Practical Work in Safety Organisation" was the subject of the annual conference of safety officers from firms which are members of the National Safety First Association, held on November 20th. The chairman, Mr. A. E. Wiseman, said that he had just returned from a visit to Canada and the United States of America, where the subject of organised accident prevention received far more attention than it did in this country. It was realised over there that only 15 per cent. of industrial accidents could be avoided by the guarding of machinery, the balance being mainly human failures, which could best be corrected by educative means. Mr. Eaton, of British Insulated Cables, Ltd., referring to the Association's weekly poster method of educating the worker, emphasised the importance of an adequate supply of posters, and of designs which attracted notice. He stressed the importance of first aid, and favoured the system of having all injuries attended at a central surgery, instead of at ambulance boxes scattered through the works. Mr. G. H. Hopkinson treated the subject from a psychological point of view, and contended that very often the primary cause of an accident, which might be due to mental reasons, was overlooked. He strongly advocated the transference of workers from tasks they were unfitted to carry out with proper safety to work of a more suitable nature. Mr. Stevenson Taylor (Home Office) said that where employers could satisfy H.M. Chief Inspector of Factories that an adequate ambulance room, with easy access from all parts, and with suitable attendants, was provided, he thought it would be possible to obtain an exemption certificate as regarded the ambulance boxes. Mr. Douglas (Metropolitan Railway) referred to the advantage of also having home-made posters, and stated that they encouraged suggestions for slogans from the workers. Mr. Fullwood said that first-aid boxes saved time, and enabled prompt attention to be given to small wounds. Miss Miln was of the opinion that if the competitive spirit in accident prevention was encouraged it would be a means of suppressing the reporting of small accidents which, if not attended to at once, might become septic. Mr. C. G. Ingall (Safety Engineer of the Association) said that with regard to the safety competitions only those accidents involving loss of time of more than the day or shift on which the accident occurred must be taken into account. The inclusion of the minor injuries would certainly tend to the suppression of reporting, and very much increase the risk of sepsis.

A Gas Tragedy.

Last week, at Stockport, the worst tragedy within our recollection arising out of the public supply of gas took place—an entire family, man and wife and four children, was found

dead. Eleven people living in adjoining houses were seriously affected, the cause of the disaster being a fracture in a 2-inch gas main under the pavement near the houses, into which the gas penetrated through the soil. It is stated that the whole street seemed to be full of gas, which must have been escaping from the main during the night for many hours.

Appointments Vacant.

Four charge engineers (£450), four boiler-house charge engineers (£400), four switchgear control room operators (110s.), four assistant control room operators (79s.) for the London Power Co., Ltd. Resident assistant engineer and clerk of works (£5) for the Severalls Mental Hospital, Colchester. Assistant power-station superintendent (£728) for the Municipality of Singapore Electricity Department. Shift charge engineer for the Borough of Dover Electricity Department. Chief instrument inspector for the Oriental Telephone and Electric Co., Ltd. Showroom, sales and publicity manager (£300) for the Borough of Eastbourne Electricity Department. (See our advertisement pages to-day.)

The Electricity Supply Rifle League.

On Saturday last the Rifle League held a dinner and prize distribution at the Talbot Restaurant, London Wall, the president, Mr. R. S. Downe, M.I.E.E., being in the chair. After the loyal toast, that of "The League" was proposed by Mr. A. H. Allen, M.I.E.E. (ELECTRICAL REVIEW), and the hon. secretary, Mr. E. Mathews (Hackney), in responding, said that that was the first dinner since 1914. Eight clubs were competing, but 18 had been represented since the League was started in 1912. The prizes were then distributed by the president, the winners of the shield in Division 1 being Central Co. "A" team (after a tie with City Co. "A" team), and in Division 2, City Co. "B" team. The S.M.R.C. silver medal for the best average in the League was won by Mr. F. O. Andrews (St. James) with a score of 97.09. "Possibles" were registered during the season by Messrs. A. Rigg (Shoreditch) and J. McNeil (City Co.).

Mr. G. C. Weston, M.I.E.E., proposed the health of the chairman, who briefly responded, and the toast of "The Visitors" was given by Mr. C. P. Fox, B.Sc., Major B. Holding (*The Electrician*) responding. The proceedings were enlivened by an ample supply of musical items by "The Golden Pippins" concert party.

M.E.T.A. Smoking Concert.

The Meter Engineers' Technical Association held a successful smoking concert on November 24th, at the White Horse Restaurant, Holborn, and the homely feeling that is always prevalent at the Association's functions was very much in evidence. The chairman, Mr. G. D. Malcolm (president of the Association), referred to the success that had attended the organisation, and attributed it to the efforts of the officers of the Association. In particular he mentioned Mr. Shotter, immediate past-president, Mr. E. W. Hill, vice-president, Mr. A. Middleton, hon. secretary, Mr. W. E. C. Alliss, hon. treasurer, Mr. F. C. Knowles, hon. assistant secretary, Mr. Gerhardi, and Mr. Mathews, chairman of the social committee, to whom all were indebted for the very excellent programme presented that evening. In conclusion, he exhorted all members to carry the M.E.T.A. spirit into the Institution of Electrical Engineers, and reminded them that their work was far from finished.

E.A.W. Activities.

Miss N. E. Miller (publicity manager, Edison Swan Electrical Co., Ltd.) gave a very interesting lecture before the Electrical Association for Women on November 26th, on "Planning a National Lamp Sales Campaign."

A meeting of unusual interest was held on November 28th, at the London headquarters of the Association, when Mr. R. W. Kennedy (Electrical Contractors' Association) opened a debate on "The Commonsense Handling of Domestic Electrical Equipment." He pointed out that there were two schools of thought among electrical men, one claiming that the public should be educated to handle electrical equipment with care and understanding; while the other side claimed that such efforts might "frighten" users and retard electrical development. Mr. Kennedy dealt frankly with the two recent "bath" fatalities, explaining the possible danger of taking unearthed portable equipment into a bathroom, and directing attention to Mr. A. A. Campbell Swinton's recent letter to *The Times*, in which it was urged that "something should be done" to persuade the public not to do these ill-advised things.

Two much-enjoyed outings have been made by the members of the newly-formed branch of the E.A.W. in North Wales. The first was to the Metropolitan-Vickers works at Trafford Park, Manchester, and the second to Dr. and Mrs. Z. de Ferranti's all-electric house at Deganwy.

The Glasgow and District Branch of the Association held a successful whist drive on November 19th.

Cost of Electricity in London.

The London and Home Counties Joint Electricity Authority has authorised a special committee to review the charges and conditions imposed by electricity undertakers in its district and it is now in communication with the local authorities and electricity companies concerned. The Electricity Commissioners suggested that any steps which might be taken as a result of a review of the kind indicated to make the bases of the charges more uniform in relation to supplies of electricity, the provision of electricity services, the hire of meters, &c., would be of advantage to the public and would tend to promote the development of the supply of electricity in the district as a whole. The Commissioners suggested that the review should be more particularly directed to:—

A comparison of the bases and amounts of the various charges and tariffs adopted by authorised undertakers in the district for supplies of electricity for lighting, for general domestic purposes, and for power purposes, respectively; the charges made for the hire of ordinary electricity meters and also for prepayment meters and any fittings installed in connection therewith; the extent to which the charges and tariffs in the case of individual undertakings were due to peculiar circumstances of the undertakings concerned; the steps which could be taken to secure greater uniformity of charges and tariffs throughout the district; the form of multi-part tariff or tariffs best suited to the requirements of the district, and the steps necessary to bring about the general adoption of such a tariff or tariffs within the district; the facilities afforded by authorised undertakings in the district with regard to the hiring of apparatus, &c., hire purchase, and assisted wiring in order to encourage the domestic demand, and so reduce prices; and the effect upon charges for electricity of the sliding scales of price and dividend prescribed by the London Electricity Acts, 1925, and by other special or provisional orders in force in the district. The special committee's report to the Joint Electricity Authority on the Commissioners' suggestions quotes figures showing variations of the flat rate or commencing charge per unit for lighting on July 1st, 1928: the highest were 10d. a kWh charged by four companies and 9d. by ten companies and one local authority; the lowest figures were 3d. charged by one local authority and 3½d. by one company and five local authorities. The Committee reports that the Commissioners were, in the first place, asked to undertake the review, but they requested that the J.E.A. should do so.

Manchester Electricity Works Extension.

On Thursday last week, as related on p. 970, the new extension of the Manchester Corporation's generating station at Barton was formally opened. In the evening a dinner was given by the Corporation, at which the Lord Mayor (Councillor Lt.-Col. G. Westcott, O.B.E.) presided. After the toast of "H.M. the King (Duke of Lancaster)" had been honoured with more than usual fervour, Dr. S. Z. DE FERRANTI gave the toast of "The Lord Mayor and Corporation." He remarked that the Corporation was a vast trading concern, employing nearly 30,000 persons, and pointed out that its success was largely dependent upon its officials, who devoted themselves to the service of the community though they could obtain higher remuneration elsewhere; he urged the Corporation not to depend too much upon idealism, but to retain upon its staff the practical business men who were essential to efficient service. Responding, the LORD MAYOR recalled that he was chairman of the Electricity Committee before the war, when the site was chosen at Barton for the new station which had proved such a magnificent venture, not only for Manchester, but also for the districts in North Cheshire and South Lancashire, which it supplied in bulk. This voluntary "regional federation" had resulted in economy, and demonstrated the futility of confining municipal activities within geographical boundaries; the public advantage should over-ride local considerations.

Dr. S. L. PEARCE, C.B.E. (chief engineer, London Power Co.) proposed "The Manchester Electricity Undertaking," expressing his great pleasure in taking part in the celebration of that day. He attributed the success of the undertaking to its strong sales policy with efficient service, up-to-date engineering methods, co-operation with neighbouring authorities, and a sound financial policy. The new plant was a most notable addition to the many fine installations in this country. The striking fact that the Barton station, designed 10 years ago, still held the first place for economy bore witness to the ability of Mr. H. C. Lamb and his staff.

Ald. W. T. DAGNALL, in responding, reviewed the history of the undertaking, and paid a tribute to the efficient team work of the staff. Mr. H. C. LAMB (chief engineer and manager) also responded to the toast, referring to Dr. Pearce's gift of securing enthusiastic service from those under his control; Dr. Pearce's name would always be associated with the efficient performance of the Barton plant, the main features of which, when he settled them 10 years ago, were bold, but now were standard practice.

Alderman W. WALKER (deputy chairman of the Electricity Committee) proposed "Our Guests," and uttered a protest against thoughtless speeches and articles which misled the public to believe that electricity would become available for all purposes at 1d. per kWh; consumers who used electricity only at times of peak load must pay for the privilege. Responding, Mr. B. MOUAT-JONES, D.S.O. (principal of Manchester Municipal College of Technology) referred to the steps taken by the College to produce efficient engineers.

Councillor J HILL (chairman of the Barton Works Sub-Committee) proposed the health of the contractors for the extensions, many of whom were the same as for the original plant, and Sir PHILIP NASH, K.C.M.G., C.B., responded, expressing appreciation of the cordial co-operation of the engineers of the Corporation in carrying out the work.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Manchester Corporation Tramways Committee sat on three days last week to consider the merits of and to interview several selected candidates for the post of general manager of the tramway system, which was rendered vacant by the death of Mr. Mattinson. There were originally 19 candidates, and four of these were interviewed. The Committee eventually decided to recommend the Corporation to appoint Mr. R. S. PILCHER, the transport manager and engineer of the Edinburgh Corporation Tramways, at £2,000 per annum. The matter was to come forward at Wednesday's meeting of the Council. After being, in his early years, in the service of the Birkenhead tramways department, Mr. Pilcher went to Canada, where he received electrical engineering training with the Montreal Street Railway Co. He returned to this country and became general manager of the Aberdeen Corporation Tramways, his appointment at Edinburgh following in 1918.

Mr. R. BORLASE MATTHEWS, M.I.E.E., has been elected as a member of council of the Royal Agricultural Society of England.

Mr. GEORGE ARROWSMITH, M.Sc.(Tech.), the chief engineer of Messrs. Hick, Hargreaves & Co., Ltd., of Bolton, has been appointed a director of the company.

A reunion of old employés of the Marconi companies as the guests of Senatore MARCONI was held at the Holborn Restaurant on the night of November 29th. Every guest had been with one or other of the Marconi companies for 25 or more years, and 40 of the 47 persons having this qualification were able to be present. After the toast of "The King," Senatore Marconi proposed the toast of the evening, and Mr. H. W. Allen, the first secretary of the parent company, responded. Among the guests were Colonel H. Jameson-Davis, the founder in 1897 of the original company, then known as the Wireless Telegraph & Signal Company, and Dr. J. A. Fleming, F.R.S., who has been associated with the company almost from its inception. Dr. Fleming was also celebrating his 79th birthday. It is hoped to make the reunion an annual function.

At its last meeting the Glasgow Corporation Electricity Committee agreed to record its appreciation of the services rendered by Mr. George Morgan, assistant engineer, in carrying out the duties falling to be performed by the general manager during the period between the resignation of the previous manager and the appointment of Mr. Bell, and to recommend that Mr. Morgan be granted an honorarium of £100.

Mr. FRED BRITTER, who has been on the staff of the Maidstone Corporation electricity works for eleven years, is leaving to take up an appointment with the Mawchi Mines, 800 miles north of Rangoon, Burma. On November 22nd he was presented with an attaché case and a travelling clock. Mr. Hoadley, the borough electrical engineer, made the presentation.

Mr. R. C. ROBERTS announces that in future he will be responsible for the sales of the Carron Company's electric heating and cooking products in the Midlands, and has relinquished his connection with the Hotpoint Electric Appliance Co., Ltd.

The Leyton Town Council has promoted Mr. J. W. SPEIGHT to the position of deputy borough electrical engineer and manager and placed him in the next grade, with an increase of salary of £82 per annum.

Sir WILLIAM BULL, M.P., announces that, acting on a specialist's advice, he will not offer himself as a candidate for Hammersmith at the next election.

Mr. D. E. BELL, general manager and engineer of the St. Helens Corporation Tramways, has been appointed general manager of the Yorkshire (Woollen District) Electric Tramways, Ltd.

On November 27th the Mayor of West Ham presented an illuminated address from the Council to Mr. C. E. ACOCK for services rendered at the generating station during the Thames flood on January 7th. The address set forth the fact that at great personal risk to himself, and notwithstanding the possibility of serious injury by explosion, Mr. Acock pluckily remained at his post for five hours waist deep in water, and was successful by his unflinching devotion to duty in most trying circumstances, in keeping the steam-driven rotary boiler-feed pump working, thus helping considerably to maintain the supply of electricity. Mr. Acock replied, thanking the Council for its appreciation.

Mr. GEORGE H. SAMMONS has been appointed as general distribution assistant to the Wolverhampton Corporation Electricity Department.

Mr. W. E. SWALE, of Stoke-on-Trent, has been appointed to the staff of the Manchester Corporation Electricity Department as power sales assistant. Mr. Swale has had nearly ten years' service with the Metropolitan-Vickers Electrical Co., Ltd., and for the last six years has occupied the position of sales representative in the North Staffordshire area.

Obituary.—MR. S. WHITE.—Mr. Samuel White, chairman of the Bristol Tramways & Carriage Co., Ltd., who, with his brother, the late Sir George White, was actively connected with the construction and development of the Bristol electric tramway system which, though not the first, was practically a pioneering overhead electric trolley line in this country, died on November 29th, at the age of 67 years. Together with the late Sir J. Clifton Robinson and other well-known men, the brothers White were also interested in similar electric tramway development work in London. Mr. Samuel White had been ill for more than two years.

MR. J. FISHER. — We regret having to record the sudden passing of Mr. Joseph Fisher, managing director of Messrs. J. Fisher, Ltd., who was so well known throughout the glass trade, both at home and abroad. He died at Hastings, where, as usual, he was spending the winter, on November 14th, at the age of 77 years. He had not enjoyed the best of health for some years, but during last summer was able to make his business calls in the City. He contracted pneumonia for a second time, the day before his death. He carried on his business right up to the last. He excelled in his work as an artist and a creator of beautiful things in glass.

MR. R. A. DALZELL. —We regret to record the death of Mr. Reginald Alexander Dalzell, which occurred under sad and tragic circumstances at Dulwich Village on Tuesday, November 27th, in his 63rd year. Mr. Dalzell was appointed Director of Telegraphs and Telephones in July, 1922, and we published a full account of his life and career in the ELECTRICAL REVIEW for August 4th, 1922. He was born at Poona in 1865, and as long ago as 1881 he entered the telephone service in this country with the companies that preceded the National Company, and with the latter itself. He went over to the State with the National service in 1912, and, after several promotions, became Director of Telegraphs and Telephones ten years later under Mr. Kellaway, the then Postmaster-General. Mr. Dalzell retired in July, 1927. The funeral took place at Kensington Cemetery, Hanwell, on Friday last.

Will.—Mr. H. MATTINSON, manager and engineer to the Manchester Corporation Tramways, left £7,369 gross and £3,992 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

"Phantestra" (Renn's Gramophone and Wireless), Ltd.—Public company. Registered November 27th. Capital: £250,000 in 5s. shares. Objects: To acquire the trade mark "Phantestra" and the goodwill of the business in connection with which it is used, to acquire the undertakings of Renn Hounam & Co., Ltd., Sterte Manufacturing Company, Ltd., and Phantom Orchestras, Ltd., to adopt an agreement with the Union Trust and Agency, Ltd., and to carry on the business of manufacturers of and dealers in gramophones, phonographs, records, wireless apparatus, musical instruments, &c. The minimum cash subscription is £7. The subscribers (each signing for one share) are: R. A. Kennedy, 62, London Wall, E.C.2, solicitor's manager; G. L. Butler, 135, Goldhurst Terrace, Hampstead, N.W.6, company secretary, and five others. Secretary: H. S. Alexander. Registered office: 62, London Wall, E.C.2.

Brecknell, Munro & Rogers (1928), Ltd.—Private company. Registered November 26th. Capital, £75,000 in £1 shares. Objects: To acquire certain property and assets of the Thrissel Engineering Company, Ltd., lately known as Brecknell, Munro & Rogers, Ltd., and to adopt an agreement between the last-named and the Imperial Tobacco Co. (of Great Britain and Ireland), Ltd. (for this company), and to carry on the business of ironfounders, electrical engineers, &c. The directors are: A. H. Downes-Shaw, 1, Upper Belgrave Road, Clifton, Bristol; P. V. Roberts, Moorlands, Rockleaze, Sneyd Park, Bristol, C.A.; R. M. E. Reeves, address not stated. Solicitors: Trower, Still & Keeling, 5, New Square, Lincoln's Inn, W.C.

British Shade Manufacturers, Ltd.—Private company. Registered November 27th. Capital, £100 in 1s. shares. Objects:—To carry on the business of manufacturers of lamp shades in non-inflammable materials, silks, parchments, cellulose-acetex, glass or other materials. The subscribers (each with one share) are:—Elaine G. de-la-Haye, 71-2, Bromsgrove Street, Birmingham, manufacturer; H. L. Ledbury-Moore, 62, St. Benedicts Road, Small Heath, Birmingham, public accountant. Secretary: H. L. Ledbury-Moore. Registered office: 71 and 72, Bromsgrove Street, Birmingham.

Pearl Electrical Co., Ltd.—Private company. Registered November 30th. Capital, £100 in £1 shares. Objects:—To adopt an agreement with the Lunar Electrical Co., Ltd., and to carry on the business of agents, factors and importers of all kinds of electrical goods and equipment, electrical and mechanical engineers, &c. The first directors are:—H. Feneron, 124, Wellesley Road, Chiswick, W., electrical agent; G. N. Cuthbert, address not stated. W. R. Preston, address not stated; A. M. Scales, 203, Barcombe Avenue, Streatham, S.W.2, electrical importer. Solicitors: Herbert Oppenheimer, Nathan & Vandyk, 1, Finsbury Square, E.C.2.

L. & E. Bristow, Ltd.—Private company. Registered November 26th. Capital, £2,000 in £1 shares. Objects: To acquire the business of electrical engineers and contractors formerly carried on by L. Bristow and E. Bristow, at 40, Sloane Street, 5, Maddox Street, Buckingham Gate, and 21, Astwood Mews, all in London, and to carry on that business, &c. The first directors are: E. Bristow, 94, Shaftesbury Avenue, W.1, and L. Bristow, 85, Lexham Gardens, W., engineers. Registered office: 40, Sloane Street, S.W.1.

Darlington Dry Battery Co., Ltd.—Private company. Registered December 1st. Capital, £500 in £1 shares. Objects:—To acquire the business of dry battery manufacturers carried on by J. Thompson and W. V. Taylor at Valley Street, Darlington, Durham. The directors are:—J. Thompson, The Clarendon Hotel, Redcar, Yorks.; W. V. Taylor, 118, Bowman Street, Darlington; W. Ramsay, 67, Duke Street, Darlington; W. J. Riggs, "Atoville," Durham Road, Darlington; B. Chamberlain, 394, North Road, Darlington; W. Bolam, 89, Goswell Road, Gosforth, Newcastle; T. P. Woodcock, 16, Nevilledale Terrace, Durham; H. Stokell, Stillington, near Stockton. Secretary: W. V. Taylor. Registered office: 118, Bowman Street, Darlington.

Precision Radio and Manufacturing Co., Ltd.—Private company. Registered November 30th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of a manufacturer of and dealer in electrical and radio apparatus, &c., carried on by J. S. Peress at 8, Board School Road, Woking, Surrey. The first directors are:—J. S. Peress, 8, Board School Road, Woking; W. C. Powers, 56, Fleet Street, E.C.; J. J. Baldwin, 35, Caillard Road, Byfleet, Surrey. Secretary: J. J. Baldwin. Registered office: 8, Board School Road, Woking, Surrey.

Official Returns of Electrical Companies.

Mico, Ltd.—Debenture dated November 14th, 1928, to secure all moneys for which the chargee may become liable under a guarantee to the company's bankers, charged on the company's property, present and future, including uncalled capital. Holder: A. F. Hawdon, 25, Sanderson Road, Jesmond, Newcastle-upon-Tyne.

General Electric Co., Ltd.—Satisfaction to the further extent of £57,520 on or before November 9th, 1928, of mortgage debenture stock secured by trust deed dated July 22nd, 1921, securing £3,500,000.

T. W. Broadbent, Ltd.—Satisfaction in full on October 26th, 1928, of mortgage dated March 13th, 1923, securing all moneys and liabilities therein mentioned.

Betav Manufacturing Co., Ltd.—E. Lever, Chiswell House, Finsbury Pavement, Moorgate, E.C., ceased to act as receiver and manager on November 14th, 1928.

Haydey, Ltd.—W. Reynolds, 9, Heather Gardens, Golders Green, N.W.11, ceased to act as receiver and manager on November 19th, 1928.

Wilkinson, Bentley & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated October 3rd, 1928. 1,350 shares taken up. £1,350 paid. Mortgages and charges, nil.

Curtis Manufacturing Co., Ltd.—Capital, £6,000 in £1 shares. Return dated August 31st, 1928. 5,202 shares taken up. £202 paid, £5,000 considered as paid. Mortgages and charges, nil.

C. T. Briscoe & Son, Ltd.—Capital, £5,000 in £1 shares. Return dated July 20th, 1928. 2,750 shares taken up. £860 paid, £1,890 considered as paid. Mortgages and charges, nil.

Coventry Electrical Appliances, Ltd.—Capital, £10,000 in £1 shares. Return dated October 12th, 1928. 5,187 shares taken up. £5,137 paid, £50 considered as paid. Mortages and charges, nil.

Premier Wholesale Electric Co. (Stockport), Ltd.—Capital, £2,000 in £1 shares. Return dated September 11th, 1928. 1,200 shares taken up. 17s. 6d. per share called up on 800 shares. £700 paid, £400 considered as paid on 400 shares. Mortgages and charges: £269.

Edward Dewhurst, Ltd.—Capital, £20,000 in £1 shares. Return dated August 10th, 1928. 15,672 shares taken up. £1,502 paid, £14,170 considered as paid. Mortgages and charges, nil.

Rawlings Bros., Ltd.—Capital, £100,000 in 30,000 preference and 70,000 ordinary shares of £1 each. Return dated September 12th, 1928. 20,685 preference and 55,744 ordinary shares taken up. £76,429 paid. Mortgages and charges, nil.

Haxby, Yealey & Co., Ltd.—Capital, £3,600 in £1 shares. Return dated October 13th, 1928. All shares taken up. £2,600 paid, £1,000 considered as paid. Mortgages and charges: £1,200.

Geo. H. Tozer, Ltd.—Capital, £3,000 in £1 shares. Return dated August 8th, 1928. All shares taken up. £901 5s. paid (being 15s. per share on 1,195 shares and £1 per share on 5 shares), £1,800 considered as paid on 1,800 shares. Mortgages and charges, nil.

Johnson, Ross & Co., Ltd.—A. W. Kingsley, of 39-41, Parker Street, W.C.1, was appointed receiver and manager on November 23rd, 1928, under powers contained in debenture dated May 25th, 1927.

C. Barnett, Ltd.—Satisfaction in full on November 15th of debenture dated May 31st, 1928, securing £200.

City Notes.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.

The annual meeting was held on November 29th, Sir John Ferguson, K.B.E., the chairman, presiding. In moving the adoption of the report (ELEC. REV., November 23rd, p. 904), the chairman said that in comparing the profit this year of £236, with the loss last year of £45,476 it must be borne in mind that the improvement was in a great measure due to the income tax over-reserved in previous years, amounting to £20,000, now being brought to the credit of the profit and loss account. The total sales for the year were slightly less than those of 1927, and the results from their French factory were hardly less unsatisfactory than that of the previous year. The Palmer tire section had not fulfilled the expectations they had of it a year ago; but, on the other hand, their foreign branches had done well, although the turnover had only increased slightly. The principal features of the balance sheet was the wiping out of the reserve fund of £265,000, due to the revaluation of cash, stocks, debts, &c., at Persan, on the stabilisation of the French franc. The upheaval of the French economic position had undoubtedly had a dire effect upon the trading community of the country, and was in a measure accountable for the disappointing results of Persan in recent years. The board had the fullest expectation that Persan had seen the worst of such conditions, and looked forward to its contributing towards their home efforts to improve upon the past. The balance of the reserve fund—£40,716—had been carried to the credit of the profit and loss account, bringing the carry-forward up to £42,654. In 1928 the net profit at Silvertown amounted to £115,015, against £68,504 in 1927; and the profit on the foreign branches last year was £9,233, as compared with £4,216 in 1927. The losses were: Persan—1928, £47,919, 1927, £48,938; Burton, £25,217, 1928, £43,446, 1927; and the Palmer Co. £50,875 this year, as against £25,812 last year. Those figures showed that Persan had not made the desired progress. The chairman then read a lengthy report from the manager at Persan, Mr. Donald, in which he stated, *inter alia*, that in the case of rubber-insulated wires and cables, competition reached a point in 1927 where the relation of selling prices to manufacturing costs became altogether abnormal, and cable makers lost heavily. There was, however, a recent general advance in selling prices of 41 per cent. So far as the Persan works was concerned, this advance was largely anticipated by their individual action in substantially increasing selling prices after they had sustained

very severe losses in the earlier months of the year. In the latter half of the year the average shop profit was considerably increased. That that improvement in the second half-year was not more apparent in the net annual result was due to the fact that in the latter period it was more than offset by the double burden of special depreciation and of general overhead expenditure. They had now established new relations with other branches of the automobile industry, and there was every indication that in connection with that branch of the business they were on the eve of a great expansion of activity. There was every reason to be confident that in the course of the year now opening they would be able to make steady and fairly rapid progress towards complete recovery. They would gather from that report, continued the chairman, that Persan had apparently turned the corner, and all that was now required was an increased turnover, which appeared to be in sight. Commenting on the fact that the loss at Burton was considerably less this year than last, Sir John quoted with satisfaction the report of the chief works accountant there, in the course of which he stated that Burton had now shown that, given the work to do, it could produce efficiently enough to earn good profits, and that if its output could be maintained in a comparatively steady flow, even better shop profits could be extracted. As to Silvertown, the position there was satisfactory, and would have been more so had the sales kept up in cash value to last year's standard, but owing to keen competition the turnover did not reach that of the preceding year. During the last two years the works manager had been doing his utmost to reduce the production and overhead expenditure, and, assisted by their efficient works account department and heads of departments generally, had succeeded in making very important economies in these accounts. The works manager reported that work was being done to-day that years ago would have taken twice and three times as long to turn out. Their motors and dynamos had been, and were still, the finest in the country, but their cost, as turned out by the Engineering Department, and the length of time taken to execute the orders, were two of the factors that made it impossible to sell them and so led to the decision to close down the Electric Light Department. This year's losses in the Palmer Tyre Co. appeared abnormally high, and the board had thought it necessary to at once make a detailed inquiry as to the cause, and correct what appeared to be an extravagant selling organisation. This work was now in hand, and they hoped to reduce the cost of selling to a reasonable figure in relationship to the cost of production. With reference to the combined activities of their five foreign branches in Buenos Aires, Calcutta, Christchurch (New Zealand), Durban and Melbourne, a net profit of £9,286 had been earned, due chiefly to the successful working of the first three branches; the last two had shown a loss. Submarine cable work had again been difficult to obtain during the year under review, with the result that the c.s. *Silvergray* had had little employment during that period. She had, however, been more active during the current year, and was at present working on her second repair job.

Col. A. W. Jarvis, C.M.G., seconded the motion. Replying on a short discussion, Mr. Gray, the managing director, said it was only at Persan that at the moment they had given up the manufacture of wires and cables because they were manufacturing at a loss. Since then, however, prices had been advanced by 41 per cent., and he had no doubt that Persan would take advantage of that rise to continue to make wires and cables. Silvertown was not equipped for the manufacture of electric cables for transmission purposes, and to start that business would mean the expenditure of an extraordinarily large sum of money which he could not advise at the present moment. The report was adopted.

Western Telegraph Co., Ltd.

The report issued last week covers the nine months ended March 31st, 1928. It shows a revenue of £1,009,853, and working expenses of £632,261. After providing for debenture interest and taxation, and adding £429,352 brought forward, there is an available sum of £713,340. Three dividends of 2½ per cent., free of tax, have been paid, making 7½ per cent., and a balance of £479,419 is to be transferred to the general reserve fund. At the meeting yesterday the shareholders were to be asked to sanction a technical alteration in the company's articles of association relative to its operations in Portugal.

Burndept Wireless (1928), Ltd.

The statutory meeting of this company was held on November 28th. Mr. C. W. Rooke (chairman), who presided, said that the scheme approved by all parties had been carried through without modification, and it was significant of the confidence of the old shareholders that a very large majority of them came into the scheme, and many put in applications for excess shares, the issue being largely over-subscribed. The first charge held by the bank and the second debentures had all been paid off, and the company started free from prior encumbrances, and with liabilities only in respect of trade contracts and the notes issued to the creditors of the old company in satisfaction of their claims. The radio trade at present was good, and the company was receiving a larger share of orders than it had done for some years. The Blackheath factory had been working at full capacity for the last two months, and it had been found necessary to lay down further plant. Although the margin of profit was not so great as in the earlier days, it was adequate, and the standard of the apparatus was being maintained. The company's new sets had met with an excellent reception. They intended to undertake further improved models, including a radio gramophone. In conclusion, Mr. Rooke spoke of the qualifications of the directors for their positions, and said that they had an excellent technical and sales staff.

Cape Electric Tramways, Ltd.

Mr. L. Breitmeyer (chairman) presided at the annual meeting on November 28th. In presenting the report and accounts (ELEC. REV., November 23rd, p. 904), he said that the past year had been an anxious one owing to unfair competition, and the results had been disappointing. The advantage of the increased volume of traffic was completely lost by the necessary reduction of fares and increased expenditure. The serious congestion in Cape Town called for an immediate remedy, *i.e.*, the regulating of the number of passenger-carrying vehicles according to requirements. Motor-'buses should not be permitted to run on routes already sufficiently served. As it was, 'buses were rushed into service during the peak traffic periods and taken off again as soon as the rush was over, making the tramway service, which was regular, costly and unremunerative. The company also had to pay road-paving charges which the 'buses escaped; last year £30,000 was expended in that way in Cape Town alone. Regulations which had been put into force were being practically disregarded, and until they were more rigidly enforced the unfair competition would continue. This was the first occasion for many years that the ordinary dividend had been passed; there was just a hope that they would be able to declare an interim dividend next June, if they had a good summer season and found that they had reached the bedrock of their troubles. The report and accounts were adopted.

Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary :—

Accumulators (Birmingham), Ltd.
Advance Wireless, Ltd.
Atlas Wireless Co., Ltd.
Bastian Electric Co., Ltd.
City of Freetown (Sierra Leone) Electricity Co., Ltd.
Cooke & Whitfield Wireless, Ltd.
East Lancashire Electrical Co. (Accrington), Ltd.
Electrical & Allied Instrument Manufacturing Co., Ltd.
Electrical Specialities, Ltd.
Farndons Electric, Ltd.
Houghton's Electrical Engineering Co., Ltd.
Magnetic Transmission Co., Ltd.
Railway Phonopores, Ltd.
Thor Electric Safety Lamp Co., Ltd.
Vauxhall Electrical Manufacturing Co., Ltd.
Wireless Association of Great Britain, Ltd.
Woodhall Wireless Manufacturing Co., Ltd.

Southern Brazil Electric Co., Ltd.

The annual meeting of this company was held on November 30th, Mr. E. H. Tootal (chairman) presiding. In presenting the report and accounts (*vide* our last issue, p. 949), the chairman said that there had been an improvement, although the results had not come up to expectations. The improvement had continued during the current year. The funds raised by the issue of prior lien bonds had enabled them to proceed with necessary capital expenditure, and there was no necessity yet for the issue of the balance of the authorised amount (£100,000). The increase in the capacity of the January reservoir ensured an ample supply of water for their plant for many years. The company's most important subsidiary, the Cia. Campineira, operating in the Campinas district, should experience an increased demand consequent upon the development of the district. Other towns were also showing steady progress and should in time become more important customers. They were hopeful that their managing director in Sao Paulo would be successful in securing sanction to increased charges to meet the depreciation of the Brazilian currency. The report and accounts were adopted.

Ward & Goldstone, Ltd.

In a circular which has been sent to the preference shareholders the directors state that in their opinion the value of the participating rights in the preference shares is not fairly represented in the market price. Moreover, those rights may act to the disadvantage of the shareholders generally. A little while ago an opportunity offered for combination or association with a company of great importance, which would have been invaluable to Ward & Goldstone, Ltd., but owing to the complication of the preference and participating rights it was not found practicable to proceed with negotiations. The directors therefore propose that the preference shareholders shall relinquish their participating rights and receive in *lieu* four 5s. ordinary shares for each ten preference shares held, and *pro rata*. This would involve the sub-division of the whole of the ordinary £1 shares into shares of 5s. denomination. Unless the scheme is approved by a large majority of shareholders it is not intended to proceed. The fixed dividend on the preference shares is 7 per cent. The participating rights consist of an extra ¼ per cent. for every additional 1 per cent. above 7 per cent. paid on the ordinary shares.

Venezuela Telephone and Electrical Appliances Co., Ltd.

The profit for the year ended June 30th last was £48,843, as compared with £42,376 in 1926-27. After meeting debenture interest, tax, &c., there is a balance of £35,741, from which it is proposed to pay 8 per cent. on the preference and ordinary shares, as last year. The first debenture sinking fund is to receive £1,500 and the renewals and depreciation fund £10,000, leaving £7,793 to be carried to the undivided profits account (against £5,958). Meeting: December 12th.

Marconi's Wireless Telegraph Co., Ltd.

In a statement issued this week the directors announced their intention of postponing the annual meeting until particulars have been received of the terms upon which the shareholders will be asked to exchange their shares for shares in the new Merger Company. In the meantime a further interim dividend of 10 per cent. is declared, as in July last. The directors intimate that this will be the total distribution for the year 1927, although they hope to declare an early interim dividend in respect of the current year ending December 31st.

Yarrow & Co., Ltd.

The report for the year ended June 30th last records a profit of £8,370 (against £11,305). The dividend is reduced from 7½ to 5 per cent. It is stated that, with the exception of the boiler department, the works have not been fully occupied during the year. Plant has been installed to enable the company to investigate the use of pulverised fuel for land and marine purposes.

Electrical Distribution of Yorkshire, Ltd.

At a meeting on November 27th the resolution passed on November 6th, providing for the creation of 500,000 shares of £1 each, was confirmed. Mr. R. W. Wickham (chairman) said that an issue would be made early in March next, immediately after the annual meeting, at a reasonable price.

Reduction of Capital.

Tungsten Manufacturing Co., Ltd.—A petition for the confirmation of the reduction of the capital of the company from £150,000 to £39,330 has been presented to the High Court and will be heard in London on December 10th.

Power Corporation of Canada.

An interim dividend of $1 per share has been declared on the common shares.

Quebec Power Co.

A dividend of $0.5 per common share has been declared in respect of the quarter ending December 31st. It was reported that the company was to issue £800,000 of debenture stock this week.

Chloride Electrical Storage Co., Ltd.

An interim dividend of 5 per cent., free of tax, has again been declared.

Brazilian Traction, Light and Power Co., Ltd.

A quarterly dividend of 1½ per cent. has been declared on the cumulative preference shares.

German Companies.

The *Bank of Electrical Values*, Berlin, proposes to pay for 1927-28 a dividend of 10 per cent. as in the previous year, the net profits (2,470,000 marks) having been almost the same as in 1926-27.

The *Electric Light and Power Investment Company*, Berlin, which is increasing its share capital by 12,000,000 marks to 30,000,000 marks so as to be able to effect an interchange of shares with the Siemens and Halske Company, reports net profits of 1,986,000 marks for 1927-28, against 1,936,000 marks in the previous year. The dividend is maintained at 10 per cent.

Stocks and Shares.

MONDAY EVENING.

THE bulletins from Buckingham Palace have absorbed public attention so completely during the past few days that little interest remained over for stocks and shares. The serious news of Sunday and Monday in this week exercised a depressing effect, and the majority of price-changes in our lists are downwards. The Stock Exchange, now within a month of the end of the calendar year, the time when stocktaking of various kinds becomes general, is at the mercy of various cross currents, the effect of which also is to bring about lower prices than those which have recently prevailed. There never yet was a time in the history of the Stock Exchange when violent price-movements failed to start rumours of possibilities of financial trouble, and it can scarcely be supposed that gossip would allow such an opportunity as the present to slip through its fingers without repeating the talk that is conventional after a protracted rise has been followed by a fairly considerable fall. This talk provides a safety valve; and, as it became current at least ten days prior to the Stock Exchange settlement on the Thursday in this week, plenty of time was allowed for people to make necessary arrangements in order to meet eventualities if they arose.

Why Manufacturing Shares are Lower.

No doubt a good many shares in first-rate companies have been sold in order to place their holders in funds needed for obligations incurred elsewhere. It will be noticed that shares in such companies as Callender's, Henley's, British Insulated, Enfield Cable, and several others, have given way in price during the past few days. This is due to the conditions just mentioned—namely, the need for supplying money from the sale of good-class stocks and shares, so that the cash is free to be used for the purposes of meeting losses, or calls on other shares. The Government's offer of 4½ per cent. Treasury Bonds had at first a strengthening influence upon the prices of gilt-edged securities; the news regarding the King's illness had the effect of turning prices in the contrary direction.

Canadian Marconi Madness.

The excitement in Marconis is mainly confined to Canadians and Marines. The shares of the parent company have moved but little; it seems surprising that interest in these should have subsided so noticeably. New York and Montreal have picked up the running as regards Canadian Marconis, the price of which—3s. 9d. at one time this year—has been up to £6 a share, from which it fell back to £3 within the course of a couple of days, and now is round about 1¾. There seemed to be no genuine justification for the extraordinary rise, though when Americans take a fancy to any shares they are as reckless as Paris is in the manner in which they will buy. The number of Canadian Marconis remaining in this country is small, but there still are people who gave about 4s. for their shares earlier in the present year, and have refused, so far, to part from a single share, even when they were bid 5¼. To such a wild pitch did the New York dealings in the shares attain that business in them had to be suspended for an hour or two by Wall Street brokers. For this hiatus, the reported reason was a bear squeeze in the shares, but reliable information has not been easy to obtain.

Marconi Marines.

Marconi Marines have been almost as dramatic in their movements as Canadians, the price rising from 55s. to 87s. 6d., also under the influence of strong New York support. Marconi Marines are well nigh humdrum in the ordinary way, so quietly does the price move. For the price to shoot up, as it did, 25s. within the space of twelve hours, attracted the more attention by reason of the surprise that it occasioned. Later, it dropped back to 4¼. Marconis themselves have been, as we have said, remarkably tame, having regard to the enthusiasm with which the subsidiaries' shares were run up. The price of Marconis have revolved around 78s. for nearly a week, getting away no further than a shilling a share from either side of this level. The company's £1 shares are quoted at 5, and the 7 per cent. participating preference at 4¼. Burndept Wireless remain stationary at 7s. Radio Corporation common shares of no par value have been changing hands around £78. The "A" preferred stock is 11¼.

Eastern Cable Stocks.

It will be noticed, by reference to our price-lists, that the Eastern Cable group has weakened to some extent. This seems anomalous in the face of the rises that have occurred in Marconi subsidiary shares, considering that the boomlet is supposed to be based upon the hopes of what can be accomplished in the future by the inclusion of Canadian Marconi the Marconi Marine in the merger embracing the various undertakings connected with the industry. Eastern ordinary has gone back 7 points, to 255½, and the shares in the three associated companies—Eastern Extension, Western and Globe—have also yielded ground. The reason is that stock has been turned out by people who had been holding it speculatively, and who evidently argue that, with the coming of the end of the year, when money is usually in demand, there may be a certain amount of selling of what are fairly "heavy" stocks and shares.

The Definite Merger.

Interest is aroused in the question as to how soon the merger between the British companies will be officially completed. Some people think that the directors will wait until the Wireless Telegraphs Bill has passed its third reading and received the Royal Assent. Others urge that no valid reason exists for delay over a matter which, according to their argument, can be crystallised at once into an accomplished fact. In view of the Parliamentary opposition that continues to make itself heard against the proposals, the Stock Exchange impression, so far as we have been able to gather it, leans to the view that nothing will be done at present. But this, of course, is simply surmise.

Dollar Stocks and American Gambling.

The wild gambling which has taken place in New York has had little effect upon the stocks and shares of the "dollar"

companies listed on this side. Brazilian Tractions are up 2, to 76½, after being 79½. International Holdings, after hardening to 13⅜, lost the fraction, while Hydro-Electrics, pursuing a very erratic course, stand at the time of writing at about 33. International Telephone and Telegraph Stock maintains its substantial rise at 200, American Telephone and Telegraph being equally firm at 202. Shares and bonds in the various hydro-electric companies of the United States, Canada, and Mexico have not moved to any extent. Everyone professes to be convinced that the gamble in New York has reached a dizzy height, from which only danger can be perceived, but the financial fireworks across the Atlantic continue as brilliantly as ever. When the rockets drop, and the excitement fizzles out, it is assumed that the London money market is likely to feel the repercussion of the reaction, and a good many cautious people are watching with apprehension the position in America. Meanwhile, the course of the money market on this side is very even, and a noteworthy feature is the unassailable manner in which investment stocks are absorbed. The 5,000 Callender's 6½ per cent. second preference shares that were on offer, and to which reference was made here last week, were taken within a day of its becoming known that they were obtainable.

Electricity Supply.

Changes amongst electricity supply shares are slight. Chelseas declined to 27s.; Bournemouths to 3 3/16. County of London ordinary and Metropolitan ordinary are 6d. better. Newcastle-on-Tyne and Scottish Power ordinary are a shade lower. Chiswick Electricity ordinary changed hands last Friday at 61s. 9d. Egham and Staines old and new ordinary have come nearly into line; the price is 36s. Folkestone Electric new ordinary were done at 47s. a few days ago, and Midland Counties new ordinary at 28s. 6d. The latter company's new 7 per cent. preference are quoted at 22s. 9d. Shropshire, Worcestershire and Staffordshire new ordinary maintain their premium at 8s. 9d. South Metropolitan Electric Light & Power ordinary were last dealt in at 32s. 1½d. Scottish Power new ordinary, issued at 26s., can be negotiated either as fully-paid, or partly (18s.) paid, the premium being about 4s. in both cases.

Coal and Railways.

Another new coal carbonisation company is due to appear shortly, the British Carbocite, Ltd., with a nominal capital of £150,000 in 2s. shares. At a demonstration given last week, a fire burning the company's fuel was shown in one room, and, in an adjacent room, a fire made with another fuel produced by a well-known company. The Home Railway companies are said to be watching with close attention the striking developments that are now being shown by this specialised branch of the coal industry. Prices of the Tube stocks are reactionary. Districts gained the fraction at 80¼, but Underground Electrics, income bonds and shares alike, have gone back. The 5 per cent. first mortgage debenture is 3 premium, or 99 for the fully-paid stock. Metropolitan Consolidated at 64½ is 1½ lower.

Telephones.

United River Plate Telephone shares hold their recent gain, at 9⅞. Venezuela Telephone ordinary at 24s. 3d., and the 8 per cent. preference at 25s. 3d., are unaffected by the issue of the annual report, which exhibits, once more, an increase in the annual receipts. These have shown an unbroken record of annual expansion from 1920, when the amount was £53,000, to 1928, this year producing £115,988. The company has £83,388 set aside for reserves and renewals, and there is £40,039 in an undivided profit account. Bogota Telephones at 26s. 3d. stand about 9d. higher than the new shares. Anglo-Portuguese Telephones are 22s. 6d., and Constantinople Telephones 3¼. Anglo-Orientals change hands fairly frequently at a little over 60s.

Miscellaneous Movements.

British Columbia Power "A" and "B" are better at 60 and 40, respectively. Crompton Parkinson 6 per cent. preferred ordinary eased off to 18s. 3d. Telephone Manufacturing shares have weakened to 5s. Dealings started last week in the lately-issued shares of the Aeonic Radio Company, and after being 3s. 6d., the price put on a shilling. Atlas Trusts are a shade down at 18s. 3d. Ever Ready ordinary shares came into urgent demand, and the price gained a florin at 28s. This tempted sellers, and there was a slight reaction. A market started last week in the shares of the recently-formed Ever Ready Trust. After a quiet opening at "par," the price rose to 1s. premium. Everlites kept steady at 6s. 3d. The new Metropolitan-Vickers ordinary wear a harder appearance at 28s. 9d. bid: the preference have improved to 2¾.

Vickers are easier at 11s. 6d. Guesses are being made as to what dividend may be expected next April. It is thought that the company has done at least as well in the current year as in the previous twelvemonth, in respect of which a dividend of 8 per cent. was paid. The rubber share market has a dull disposition. There is very little business doing in its lists.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price Dec. 3, 1928.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14†	15	3 3/16	—1/16	... ...
Brompton Ordinary	1	8½	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	27/-	—	5 8 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8½	8½	27/-	—6d.	5 8 8
City of London	1	10	10	30/9	—	4 16 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	6	8	39/6	+6d.	4 1 0
County of London	1	7½	7½	43/6	+6d.	8 9 1
do. do. 6% Pref.	1	6	6	23/6	—	5 2 9
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	53/3	—	4 2 8
Kensington Ordinary	1	8	8	36/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	36/6	—	5 5 8
Metropolitan	1	8	9	43/-	+6d.	4 3 9
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	—	4 5 3
Mid. Elec. Power	1	—	15	2	+6d.	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	25/-	—3d.	4 16 0
do. 7% Pref. ...	1	7	7	35/-	—	5 9 8
Notting Hill 6% Pref.	10	6	6	10⅞	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—6d.	5 0 0
South London	1	8½	8½	27/6	—	5 9 8
Urban Ordinary	1	7	7	38/3	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

†4% of which was tax free.

Home Rails.

Central London Ord. Assented ...	Stock	4	4	73	—	5 9 7
Metropolitan	,,	8	8	64½	—1½	4 13 0
do. District	,,	8½	4	80½	+½	4 19 5
Underground Electric	£1	1½	6	26 6	—6d.	5 15 6
do. do. Income ...	Bonds	6	6	127	—2	4 16 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	,,	1½	1½	24⅜	+⅛	6 2 0
Automatic Telephone	1	10	10	2½	—	4 14 1
Eastern Extension	10	10	10	25⅜	—⅛	*3 18 2
Eastern Tel. Ord.	Stock	10	10	255½	—7	*3 18 6
Globe Tel. and T. Ord.	10	10	10	25½	—⅜	*3 18 6
do. do. Pref.	10	6	6	11⅛	—	5 8 1
Great Northern Tel.	10	20	20	29½	—½	... ...
Indo-European	25	10	10	47½	—	*5 5 8
Marconi	10/-	*5	*10	78/3	—	... ...
Marconi-Marine	1	8⅜	12½	4⅜	+1⅛	2 17 0
Oriental Telephone Ord.	1	12	12	8 1/16	—	*3 18 0
United R. Plate Tel.	5	8	8	9⅞	—	*4 5 6
Western Telegraph	10	10	10	25½	—⅜	3 18 6

*Interim.

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8 1/16	+1/16	7 9 2
do. do. 2nd. Pref. ...	5	6	6	8½	—	8 11 6
do. do. 5% Deb. ...	Stock	5	5	73	—	6 8 2
British Electric Traction Def. Ord.	,,	—	—	585	+15	... ...
do. do. Pref. Ord.	,,	8	7½	124	—	5 19 0
Brazil Traction	100	6	7	76½	+2	2 5 9
Brit. Colombia Elec. Rly. Pcc. ...	Stock	5	5	96½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	62	—	6 9 1
Mexico Trams, 5% Bonds	—	5	5	81	—	6 3 5
Mexican Light Common	100	Nil	Nil	81	—1½	... ...
do. 7% Pref.	100	Nil	7	78½	—1½	8 18 4
do. 1st Bonds	—	5	5	77	—	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	6/-	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	15	67/-	—	*4 9 9
British Aluminium Ord.	1	10	10	43/-	—9d.	*4 13 0
British Elec. Transformer Pref....	1	7	7	18/-	—	7 15 0
British Insulated Ord.	1	15	15	4 1/16	—1/16	3 14 0
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4	—⅛	3 15 0
do 6½% Pref.	1	6½	6½	1⅝	—	5 4 0
Crompton Parkinson Ord.... ...	£/-	—	—	20/6	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	£/-	10	10	12/6	—	3 4 0
do. 5% Deb.	Stock	5	5	89½	—	5 11 9
Electric Construction	1	7½	7½	26/9	—9d.	5 12 1
Enfield Cable Ord.	1	20	20	4 1/16	—1/16	4 6 7
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	25/-	—	5 4 0
do. Ord.	1	7½	10	41/-	—1/-	4 17 7
Henley	1	25	25	5⅜	—1/16	4 9 0
do. 4½% Pref.	5	4½	4½	4⅛	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—⅛	... ...
Johnson & Phillips	1	12½	10	38/9	—	5 8 3
Met.-Vickers Ord.	1	8	8	28/9	—	... ...
do. Pref.	2	8	8	2⅞	+1/16	5 16 5
Siemens Ord.	1	7½	7½	26/3xd.	—1/16	5 14 2
Telegraph Construction	12	10	10	25	—	*4 16 0

*Dividends paid free of Income Tax.

Electrical Imports of Spain.

Statistics for 1926 and 1927 Compared.

THE following figures, showing the imports of electrical goods into Spain in 1927, are taken from the recently issued trade statistics. The totals for 1926 are given for purposes of comparison, and notes of increases or decreases added.

	1926. Quantities. 100 kg.	1927. Quantities. 100 kg.	Inc. or dec. 100 kg.
Dynamos, motors, transformers, switchgear, &c.—			
Total	41,985	48,550	+6,565
From Germany	11,348	11,110	− 238
„ United States	4,456	3,310	−1,146
„ France	9,690	13,023	+3,333
„ Great Britain	2,389	5,040	+2,651
„ Sweden	3,469	3,180	− 289
„ Belgium	1,025	830	− 195
„ Switzerland	6,811	9,220	+2,409
„ Italy	*	730	—
„ Holland	*	1,524	—
Self-contained generating sets—			
Total	2,285	5,676	+3,391
From Germany	613	780	+ 167
„ France	469	2,440	+1,971
„ Great Britain	479	1,350	+ 871
„ United States	94	270	+ 176
„ Switzerland	*	650	—
Switchboards—			
Total	977	839	− 138
From Germany	206	181	− 25
„ United States	136	22	− 114
„ France	425	225	− 200
„ Great Britain	76	108	+ 32
Electrical fittings (switches, lampholders, &c.)—			
Total	5,408	7,710	+2,302
From United States	1,281	980	− 301
„ Germany	1,490	1,850	+ 360
„ Great Britain	488	480	− 8
„ Belgium	*	600	—
Electrical measuring instruments and parts thereof—			
Total	1,558	1,760	+ 202
From Germany	824	900	+ 76
„ France	218	190	− 28
„ Switzerland	328	497	+ 169
„ Great Britain	5	22	+ 17
Stoves, heaters, cookers, irons, &c.—			
Total	408	680	+ 272
From Germany	68	160	+ 92
„ Switzerland	139	350	+ 211
Accumulators, dry batteries, and parts—			
Total	5,527	6,870	+1,343
From Denmark	1,130	1,040	+ 10
„ Germany	936	1,360	+ 424
„ Great Britain	537	640	+ 103
„ United States	1,451	2,197	+ 746
„ France	975	1,160	+ 185
„ Norway	38	1	− 37
„ Sweden	*	130	—
Wires and cables—			
Total	31,411	32,360	+ 949
From Great Britain	21,005	17,820	−3,185
„ Germany	3,113	3,390	+ 277
„ France	5,652	8,840	+3,188
„ United States	16	250	+ 234
Incandescent electric lamps—			
Total	818	127	− 691
From Holland	731	71	− 660
„ Great Britain	12	1	− 11
„ France	28	15	− 13
Telegraph and telephone switchboards and apparatus—			
Total	5,818	5,820	+ 2
From France	662	317	− 345
„ Belgium	3,932	4,568	+ 636
„ Germany	141	284	+ 143
„ Great Britain	267	162	− 105
„ United States	372	360	− 12
„ Sweden	340	340	—
Wireless valves—			
Total	16	17	+ 1
From Germany	*	5	—
„ United States	*	7	—
„ France	*	4	—
Electric mercury vapour lamps, searchlights, &c.—			
Total	57	80	+ 23
From United States	8	5	− 3
„ France	15	4	− 11
„ Germany	*	57	—
Arc lamps and parts, &c.—			
Total	58	50	− 8
From Germany	11	13	+ 2
„ France	16	15	− 1
Carbons, other electrodes, &c.—			
Total	5,378	5,530	+ 152
From United States	2,432	3,190	+ 758
„ Great Britain	742	754	+ 12
„ Germany	769	230	− 539
„ France	957	1,150	+ 193
Insulating tapes, fabrics, and tubes—			
Total	4,750	12,970	+8,220
From United States	3,944	11,670	+7,726
„ Germany	212	1,055	+ 843
„ Great Britain	16	40	+ 24
„ Switzerland	8	4	− 4

* Unspecified.

United States Battery Production.

The Department of Commerce, Washington, announces that, according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged in the manufacture of batteries in 1927 reported products valued at $150,451,796, a decrease of 3.1 per cent. as compared with $155,247,811 for 1925, the preceding census year. The production for 1927 was as follows: Storage batteries, $80,496,735; parts and supplies for storage batteries, $17,486,178; six-inch dry cells, $9,287,154; cells for radio anode and grid batteries, $26,907,806; cells for flashlight batteries, $6,035,659; parts and supplies for dry batteries, $6,756,241; wet primary batteries, $3,358,729; parts and supplies for wet batteries, $123,294. The production of storage batteries, six-inch dry cells, and wet primary batteries shows considerable decreases both in number and value for 1927 as compared with 1925. On the other hand, the production of anode, grid and flashlight cells increased in value from $24,922,773 to $32,943,465 in 1927, or 32.2 per cent.

The statistics for 1927 and 1925 are given in the following table:—

	1927.	1925.	Percentage increase or decrease.
Total value	$150,451,796	$155,247,811	− 3.1
Storage batteries—			
Complete batteries, value	$80,496,735	$88,870,186	− 9.4
Parts and supplies, value	$17,486,178	$21,341,597	−18.1
Dry cells, 1.5-volt—			
Six-inch—			
Number	54,985,815	63,536,044	−13.5
Value	$9,287,154	$12,315,834	−24.6
Anode and grid batteries—			
Number	530,512,320	Number 467,460,972	+42.0
Value	$26,907,806	Value $24,922,773	+32.2
Flashlight—			
Number	133,143,601		
Value	$6,035,659		
Parts and supplies, value	$6,756,241	$4,054,169	+66.6
Wet primary batteries—			
Complete batteries—			
Number	2,410,927	2,776,888	−13.2
Value	$3,358,729	$3,743,252	−10.3
Parts and supplies, value	$123,294	Not reported	—

The International Illumination Congress.—VII.

The Seventh Plenary Session of the International Commission on Illumination, at Saranac, U.S.A.

(By OUR OWN CORRESPONDENTS.)

Natural Lighting.

IN the midst of considerations of artificial light the problems of natural lighting were not forgotten. The British Secretariat Report was preceded by two papers, by P. J. Waldram and by J. G. West, which treated the subject from the points of view of public health and of practical architectural design. Natural lighting is, of course, far more concerned than artificial lighting with the design of the building and of its fenestration, and with the design of neighbouring buildings. Mr. Waldram discussed in his paper the probable effects on the health and well-being of the community of inadequate daylight; the legal processes necessary to secure sufficient daylight; and the necessity of establishing a criterion of adequacy. The interesting suggestion was made that positions from which at the working plane the sky was not directly visible would in general be insufficiently lighted, and that the construction of rooms in which a large portion of the working plane received no direct light was undesirable.

Mr. West dealt with the same question in the development of a site for office buildings, and invesigated on the above basis the relative merits of several schemes of planning with different arrangements of light wells.

The British Secretariat Report stated the methods in use for expressing and measuring daylight, and suggested a standard sky brightness of $(5{,}000/\pi)(\text{CP}/m^2)$ which should be agreed as the lowest reasonable value, to which results should be related. This was adopted. The state of knowledge of various branches of the subject and possible lines of future work were outlined in the Report.

Messrs. H. Buckley and J. Macintyre's paper discussed the problems of the fading of museum specimens. Light is only one of several agencies at work in causing fading of dyed fabrics and of paintings; and, while light of all wave-lengths has an effect, the violet and ultra-violet region is the most active. The use of various systems of coloured glasses and special glasses for the glazing of skylights was investigated in detail, and the colour distortion likely to occur as a result of their use was shown. An interesting suggestion was made to use a quinine compound, which is opaque to radiation below 0.39μ as a filter, either on glass or incorporated in a varnish for the pictures.

The medical effects of daylight are believed to be largely connected with the radiation in the ultra-violet end of the spectrum, and Dr. Kimball's paper on "The Distribution of Energy in the Visible Spectrum of Sunlight, Skylight, and Total Daylight," formed a valuable contribution, giving figures for the effects of the different constituents of the atmosphere on the solar energy distribution. He showed how the shorter wave-lengths are almost entirely lacking after the radiation has passed through the dust-laden atmosphere of industrial towns such as Chicago, and suggested that such a depletion might affect the health of the community.

Glass.

It is remarkable that the subject which involved the greatest complications and mathematical intricacies was concerned with a very ordinary piece of illuminating equipment—the diffusing globe. While it is a comparatively simple matter to test a given sample globe in conjunction with a given gallery and lamp, it is a very different matter to make a pronouncement on the material from which it is made, or to predict the performance of a piece of glassware of given shape, having given the optical properties of a sample of the glass. The subject is manifestly one which calls for further study, although much work has already been done. Dr. Pirani at Saranac described in his paper on "Experimental Studies of Liquid Models of Diffusing Media" some of the experiments which he has carried out with a view to determining the relations between the physical and the optical properties of diffusing materials. Owing to the inevitable variations in particle size and number which take place in the thickness of opal glasses, experiments were carried out upon liquid models in which the medium could be made homogeneous.

The apparatus and precautions necessary for the accurate determination of the optical properties of samples of diffusing media were described in a paper by J. M. Waldram. The author went into the details of methods and procedure which were developed for this purpose, and described measurements which were accurate to within 0.5 per cent. It was interesting to note that the reflection factor under diffuse illumination of materials which do not approximate to the matt condition is a very difficult quantity to determine experimentally with accuracy, and in the case of a piece of plane clear glass it was found to be impossible with the apparatus described.

The Secretariat Report prepared by the German Committee went fully into the definition and description of the various forms of diffusing media used in practice, which can conveniently be divided into:—

(*a*) Matt glasses (in which scattering takes place at the surface;

(*b*) Opal glasses (in which scattering takes place in the body of the glass);

(*c*) Ornamental glasses, which are similar to the matt glasses, but in which the surface irregularities are much larger; and

(*d*) Matt opal glasses.

The Report proposed certain definitions of the optical properties of diffusing media, which were discussed at a sub-committee meeting and after some modification were submitted to the Definitions Committee. Methods of measurement were also discussed in the Report, and finally two instruments were described for the approximate measurement of samples.

In view of the incomplete knowledge of the relations of all the variables in the problem, specification based on fundamental principles was impossible; but it was agreed to state the performance of samples of opal glass in terms of the distribution of reflected and transmitted flux.

Light Flux.

The ever-increasing activities of the Commission make complete international understanding more and more necessary for rapid advance, and even in individual countries difficulties often arise where there is no generally accepted method by which apparatus or installations can be described.

There has long been felt the need for a method of describing the performance and characteristics of lighting equipment on a rational basis, so that comparisons can be made between apparatus supplied by different manufacturers. At Bellagio a Committee on "Light Flux Distribution" was formed to study this subject, and three papers had been prepared for consideration by the full meeting. Mr. Yamanti's paper on "Point-to-Point methods of determining Zonal flux" supplied information on methods of calculation which is of value when considering methods of classification. The other two papers by M. J. Wetzel and MM. H. Desarces and D. Demeure, dealt with the "Study of the Distribution of Flux and Lighting Devices" and "Their Definition by the method of Flux Distribution." In both papers the method of "Uniformity Curves" was suggested wherein the performance of the fitting is described by reference to a hypothetical fitting producing a uniform horizontal illumination. Some discussion followed the reading of the papers in abstract, and it was ascertained that the Uniformity Curve method was only applicable to certain classes of unit. A British proposition was put forward that the units should be described by a number or term indicative of the total solid angle into which a certain agreed proportion of the total flux was concentrated. Thus a floodlight might have a figure of 0.1, and a street fitting with dioptric refractor one of 6, and all classes of fittings can be included. The suggestion was not approved by all, however, and the proposition was withdrawn. It is possible that if the method be further developed some international agreement on those lines may be obtained.

At the time of the meeting some confusion arose in connection with the terms at present in use in different countries for describing the type of light distribution from a fitting, *e.g.*, extensive, intensive, and dispersive. In view of this, the Committee as a whole felt it desirable to obtain, as a first step towards the complete solution of the problem, an international list of the terms now in use, with their meanings. The Secretariat Committee was therefore requested to collect this information.

Shop Window.

Three or four of the papers submitted at Saranac were, in effect, records of the status of lighting in various countries. Usually a questionnaire had been employed to obtain information on the general practice in certain fields and on the methods used for the solution of difficult problems.

Shop window lighting was dealt with in this manner and the replies to the American Questionnaire gave useful information on the principles and practice in this branch of lighting.

The extent to which the value of shop-window lighting is appreciated may be judged from the replies to the question on the extent to which shop windows are illuminated at night. It appears that in Japan and the United States the majority of the lighting is used at night, but that in Great Britain and France quite a small proportion is thus employed.

The popular wattages of lamps are 100 and 150 W, though larger ones are occasionally used. The consumption per unit length of window front varies with the country, France employing 300 watts/foot, the United States 160 watts/foot, and England approximately 100 watts/foot in the brightly lighted districts of large cities. The practice in the smaller towns is almost universal at 40-50 watts/foot.

The replies to the questionnaire show that the individual reflector is employed approximately four times as often as troughing, and that in America silvered glass is used almost without exception. In Britain, however, prismatic and silvered glass units are used in equal numbers.

Footlights are at present little used, and the general window lighting equipment is seldom employed for overcoming objectionable daylight reflections.

There is evidence, however, that in all countries, store owners and managers realise the value of well-lighted shop windows, and it is probable that rapid development will take place generally.

General Session.

The General Session on the afternoon of Wednesday, September 26th, was set aside for the presentation of several papers on subjects not included among those discussed at the Technical Sessions. A paper by Col. Cellerier on the application of "Radiation of Various Wave-lengths to the study of Paintings in Museums and Collections," was of peculiar interest, and he was able to demonstrate with the aid of a series of fine lantern slides, the scientific methods now being used in the identification of the works of old masters and in the detection of retouches or of frauds.

Two other papers of practical importance should be mentioned. It is sometimes felt that lighting equipment cannot be useful and ornamental at the same time, and that beauty and inefficiency go together. M. Wetzel, who discussed "The Application of Rational Principles to Decorative Lighting," showed in a number of examples of ingenious designs that that was by no means the case. The design of equipment which is at once efficient and decorative, calls for the highest skill on the part of the designers and the closest collaboration between the illuminating engineer and the decorative artist. M. Wetzel demonstrated the advantage of replacing the multiplicity of low-wattage lamps usually associated with decorative fittings by one high-wattage lamp and appropriate reflecting, refracting, or diffusing equipment. Such apparatus is generally designed in one of two ways: either by first designing the "rational" equipment and then seeking to beautify it, or else by taking the artist's design and incorporating in it the necessary devices; but it is preferable for those concerned to collaborate from the beginning in the consideration of the technical and æsthetic conditions imposed. The use of concealed silvered-glass reflectors is becoming fairly well known, but the employment of a street lighting refractor in a ceiling fitting, an indirect reflector in a crystal fitting, or Fresnel lenses with louvres for ceiling illumination, suggests that the possibilities of this kind of design are by no means exhausted. Where it is possible to collaborate with the architect in the design of an interior, special devices may be used, such as apparatus built into the walls or ceilings made to an appropriate curvature, so that a single large lamp may replace the usual row in a cornice.

Dr. Luckeish drew attention to the modern trend of thought in illuminating matters towards satisfactory vision rather than merely to the slavish provision of arbitrary values of illumination on a hypothetical working plane. The final aim of a lighting scheme is to serve the eyes of its users; and they are its final judges. Lighting schemes should therefore be designed on the basis of visual data, and the criteria used should be quantities such as brightness which are directly related to visual performance rather than illumination, which is, after all, more akin to a mathematical abstraction. Dr. Luckiesh outlined the work which is at present in progress on the various aspects of the problems of vision, and indicated some of its possible practical applications in the design of schemes.

Glare.

One of the aspects of vision, namely, glare, formed the subject of one of the Technical Sessions. Although it is a most important factor in illumination and is the bugbear of the designer, glare, like hardness, is one of those phenomena which it is extraordinarily difficult even to define, and in common with most physiological phenomena, presents unusual difficulties in quantitative experiment. The Report of the Secretariat Committee was not forthcoming; but two papers by Preston Millar and S. McGray and W. S. Stiles, formed a basis of discussion. Messrs. Millar and Gray's paper was in the form of a collection of the researches conducted up to the present time, and thus formed substantially a secretariat report. A classification of the effects of glare suggested in this paper was combined with another classification in the form of a definition suggested by the British Committee and was sent to the Secretariat Committee for consideration. The British Committee suggested several lines of research which were urgently needed.

Mr. Stiles in his paper compared the work of Bordoni, Holladay, the Royal Dutch Automobile Club, and his own work at the N.P.L., on the effect of glare on the brightness difference threshold. Various experimenters have attacked the problem, each using his own methods, and the results are not in agreement. Further work is required to determine the cause of the disagreement and to determine the effects of glare along lines suggested in the paper. It is to be hoped that results will be forthcoming which may place our knowledge of this intricate subject on a sounder footing.

Photometry.

In all cases where the intercomparison of data obtained in various countries is desired, agreement on units is essential. It was logical, therefore, for the Commission to commence its activities with an attempt to correlate such standards as were in use at that time. After a considerable amount of work it was agreed between France, Great Britain and the United States, to consider the unit of candle power as obtainable from certain incandescent electric lamps in the custody of the three national laboratories. Whilst this arrangement has proved satisfactory, it has not been possible for any laboratory to construct an absolute standard which shall have a predetermined value. Investigatory work has therefore been conducted in an endeavour to obtain a reproducible standard.

Two papers were presented on this subject by Herren O. Müller and R. Frisch, in the first of which progress on the Warburg standard was recorded. The method is dependent on the direct measurement of radiations, and the necessary precision in temperature determination is obtained by the simultaneous measurement of total radiation and spectral and visual brightness. In the second paper the prospects of establishing a simplified unit by means of an absolute measurement of total radiation were discussed.

Whilst these methods hold great possibilities and the thanks of the Commission were accorded to the French and German investigators for their excellent work on the subject, much work remains to be done before they are universally applicable.

The Status of Candle Power Standards was recorded by F. C. Crittenden and J. Franklin Meyer in their paper, which introduced the subject of colour differences in photometry. Measurements under these conditions are liable to considerable inaccuracy, and a method for the elimination of empirical features was foreshadowed at Bellagio. Work has been in progress in this connection, and the Commission recommend its active prosecution by a method based upon the calculation of relative luminosities, using spectro-photometric data and the visibility factors accepted by the I.C.I. at Geneva in 1924.

The British Committee submitted a report on "Photometric Accuracy in Measurements on Electric Lamps," which, it was decided, should be included in the Proceedings of the Commission. The report summarised the accuracy of measurement obtainable and gave figures for the necessary precision of electrical measurements. Owing to the relatively large errors which are possible in the photometry, it is necessary in photometric work to reduce to a minimum the liability of errors from other causes.

Allied to photometry is the subject of colorimetry, and at the meeting of this Committee a memorandum from Mr. T. Smith was taken as the agenda. In this subject agreement on a standard mode of expressing results is necessary for progress, and as a first step it was arranged that the report of the American Committee in the *Journal* of the American Optical Society should be criticised by the British Committee, which is the other English-speaking member of the Commission.

A second step was taken in a request for further work on a redetermination of the three sensation curves on the basis of the Young-Helmholtz theory of colour vision.

Data when collected can always be submitted to the Secretariat, and in this way considerable progress should be possible before the next plenary meeting.

Conclusion.

At the final Plenary Session the various resolutions which were the outcome of 28 technical meetings, were put to the Commission in the form drawn up by the Editing Committee in French, English, and German, and were finally passed.

The illuminating interests in Great Britain may well be satisfied with the efficiency with which they were represented. The British delegation, in addition to being the largest visiting group, was thoroughly organised under the able leadership of Mr. R. Watson and Mr. P. Good; and before reaching America each member was aware of the part which he was expected to play in the discussions. In this way there was no overlapping and the British interests were properly represented at every meeting. Various other delegations adopted this principle, with the result that the efficiency and smooth running of the Commission was considerably aided.

The president and treasurer were unanimously re-elected, and Dr. Walsh was elected to the office of honorary secretary, which was previously occupied by Mr. Paterson prior to his election to the presidency. In the course of his remarks, Mr. Paterson referred to the thoroughly successful results of the

Session, which had achieved more than the most optimistic had hoped, and paid tribute to the excellent work of the Bureau and American organising staffs which had made possible the completion of so large a programme.

The time and place of the next meeting were discussed. After the receipt of invitations from the Belgian and British National Committees to hold the next meetings in their respective countries, and some discussion of the relative merits of 1930 and 1931, it was finally decided to accept the latter invitation in 1931. As the president remarked at a recent meeting of the Illuminating Engineering Society, it is none too soon for us to be considering the arrangements for the 1931 meeting, and if all the British interests are enthusiastically united there is no doubt that the eighth session will in no way fall short of the high standard set by our courteous and efficient hosts at the seventh.

Alkaline Accumulators.

A nickel-cadmium cell has been produced which is claimed to be capable of dealing with the heaviest starting conditions for commercial electric vehicles.

THE general characteristics of all alkaline accumulators with active material enclosed in perforated-metal envelopes render them particularly suitable to withstand the mechanical effects of very high discharge currents; under no conditions can the active materials be dislodged or loosened in their frame. In spite of this attractive advantage, however, it has hitherto been found impossible to utilise cells of this type for the starting of internal combustion engines, or for any particularly heavy-current duties, because of the high internal resistance of the cells.

This problem has engaged the attention of designers for many years, and in the Nife nickel-cadmium cell, as specially made for traction work, a good deal of success has been obtained, it is claimed, in the reduction of the internal resistance. This has been done by paying special attention to contact arrangements throughout the cell, by adequately designing the conductors, and particularly by utilising a larger number of thinner plates. As an instance of the progress made in this way it may be mentioned that a Nife traction cell of this design will give an average pressure of 1 volt per cell when discharging completely in 12 minutes, as against a pressure of only 0.5 volt from an ordinary nickel-iron cell under the same conditions.

The results obtained were, however, still not sufficient for the demands of starters on heavy commercial vehicles where an initial kick of the order of 500-600 A is required from a battery of only 120 Ah capacity. In conjunction with Messrs. C. A. Vandervell, who are the sole concessionaires for Nife cells for commercial-vehicle purposes, further experiments were carried out, with the result that a battery has now been perfected capable of dealing with the heaviest starting requirements. Fig. 1 shows how this has been done by introducing a corrugated nickel strip into each pocket of both the positive and negative plates, the ends of the strips being sealed down under the side frames. These patented strips act as additional conductors and have the effect of increasing enormously the maximum output from the cells.

A 60-Ah battery has been standardised for private-car purposes, and the curves in figs. 2 and 3 depict its heavy discharge performance, while the fact that an output of over 2½ kW is obtainable from this small battery indicates the remarkable progress which has been made. Apart from the high peak output for starter purposes, a remarkable feature of the design is the way in which it enables high currents to be maintained, as shown in fig. 3. From the 60-Ah battery, for example, a current of 200 A is maintained for 12 minutes.

Apart from the starter considerations, these new low-resistance alkaline cells offer advantages for many other classes of work which have hitherto been closed to this type of cell on account of the large variation between the charge and discharge voltages. It is claimed that the new battery is one with all the mechanical advantages of the steel-alkaline type, at the same time approximating the voltage characteristics of the lead-acid battery.

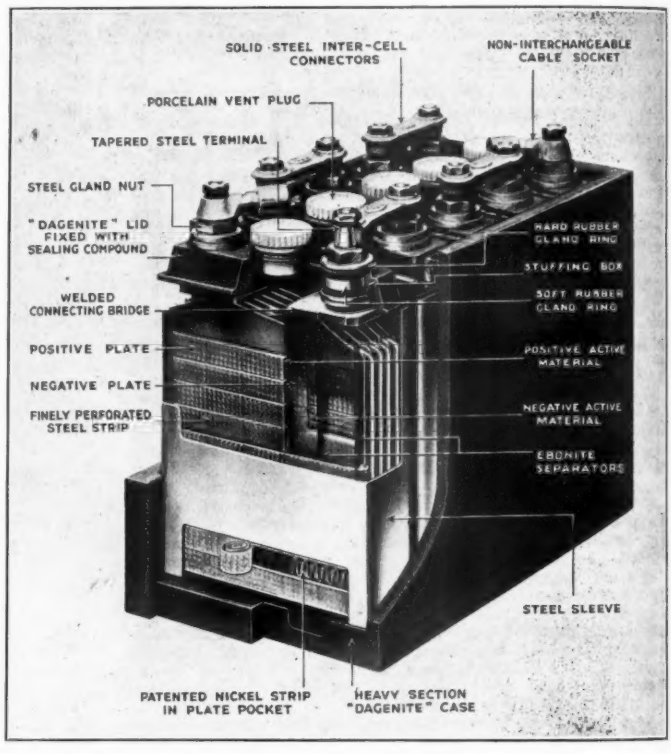
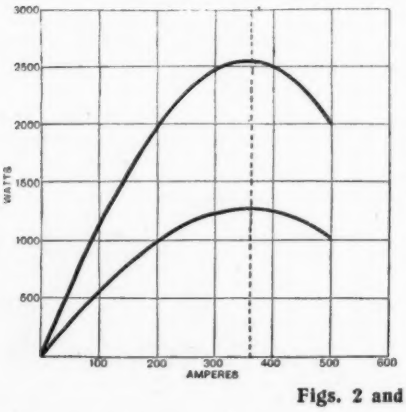
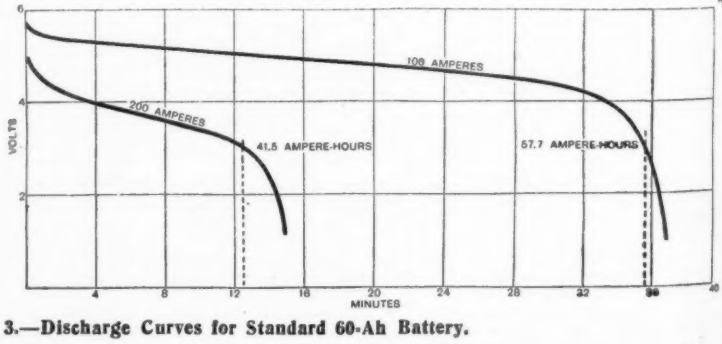


Fig. 1.—Construction of New Nickel-Cadmium Cell.





Figs. 2 and 3.—Discharge Curves for Standard 60-Ah Battery.

We are indebted for the above particulars and illustrations to Messrs. Batteries, Ltd.

Modern X-Ray Apparatus.

A survey of the electrical equipment necessary for modern work, more especially in relation to industrial applications and the examination of materials.

By L. G. H. SARSFIELD, M.Sc., A.M.I.E.E.

(*Extracts from Paper read before a joint meeting of the* INSTITUTION OF ELECTRICAL ENGINEERS *and the* BRITISH INSTITUTE OF RADIOLOGY.)

THE present range of X-ray equipment extends from the diminutive dental outfit through the many types employed in medical diagnosis and deep therapy to those designed specially for the examination of materials and the inspection of finished articles. In the last category perhaps the highest achievement is the penetration of 4½ in. of steel, performed in the Radiological Research Department of H.M. Arsenal, Woolwich, where comprehensive research into the subject was inaugrated in 1917[1].

The co-operation of medical men, physicists, and electrical engineers and "all round" co-ordinated research are still needed in order to obtain the best solutions of the questions arising in connection with continued development. Electrical engineering principles and standards are being steadily introduced in the design and arrangement of auxiliary equipment, while small generating and converting machines are now available to suit almost all sources of electric power. The source of high potential has taken two main forms: (1) the induction coil, and (2) the transformer; the latter has come into its own, and is now used with equal success in the smallest dental equipments as well as in the largest installations yet built. The measurement of current and voltage is now receiving more attention, although experimental work in this direction is long overdue. With the increasing powers now used in X-ray practice, suitable control apparatus has become of great importance.

Induct'on Coils.

From figures obtained from five leading English manufacturers, the ratio of the number of ordinary induction-coil X-ray sets to the number of transformer sets supplied during the past year, including all sizes, is approximately 1 to 20. Oil-insulated and so-called "Duplex" coils represent fairly recent development, while secondary rectifiers are also in use. Specially constructed induction coils were used by Coolidge in his recent experiments on cascade-connected cathode-ray tubes working at 900,000 volts (peak).

X-ray Transformers.

There is no British standard method of rating X-ray transformers. It has been suggested that standard sizes should be decided on, but in view of the rapidly developing technique this is undesirable as yet. The output of an X-ray transformer depends on the capacity of the X-ray tube which it has to supply. A universal medium-focus Coolidge tube, for instance, may be run at 140,000 volts (peak) and 5 mA continuously, but will carry a load of 20 mA for short periods. The deep-therapy model is rated at 200,000 volts (peak) and 5 mA continuously, but the latest water-cooled tube is designed for 250,000 volts (peak) and 50 mA. There is a great need for an agreed method of measuring secondary load, because with different schemes of rectification of the current different amounts of the total wave are employed, and the ratio "transformer current output (r.m.s.) to tube current (mean)" varies accordingly over wide limits. A B.E.S.A. Committee, called some time ago to consider the electrical performance of X-ray transformers, has issued a standard specification.

Although three-phase supply has been applied to electrical precipitation[2] and X-ray work,[3] single-phase transformers are usually adopted for the latter. Transformation ratios are high, and on account of the low voltage per turn (in the neighbourhood of 2) adopted for such small power, the number of secondary turns is very large. Core-type arrangements are most frequently met with; the shell type is, however, very suitable when the secondary winding is earthed at one end and the pressure is of the order of 100,000 volts (peak).

Primary windings call for no special precautions as regards insulation from the core, but it is advisable to insert an earthed shield between the primary and secondary, and an additional safeguard is the earthing of the primary winding through a resistance, or lamps. Primary taps are sometimes employed to permit a transformer to be supplied at voltages of fairly widely differing values, and also to compensate for small differences of line voltage. Variation of secondary voltage is obtained by varying the voltage of the primary with the help of an auto-transformer, or series resistance, or both.

The fact that the temperature-rise never reaches the values which are general with power transformers is of great assistance in reducing to a minimum the insulation employed. The mutual dependence of design of main insulation and secondary coils is more marked in the case of X-ray than of power

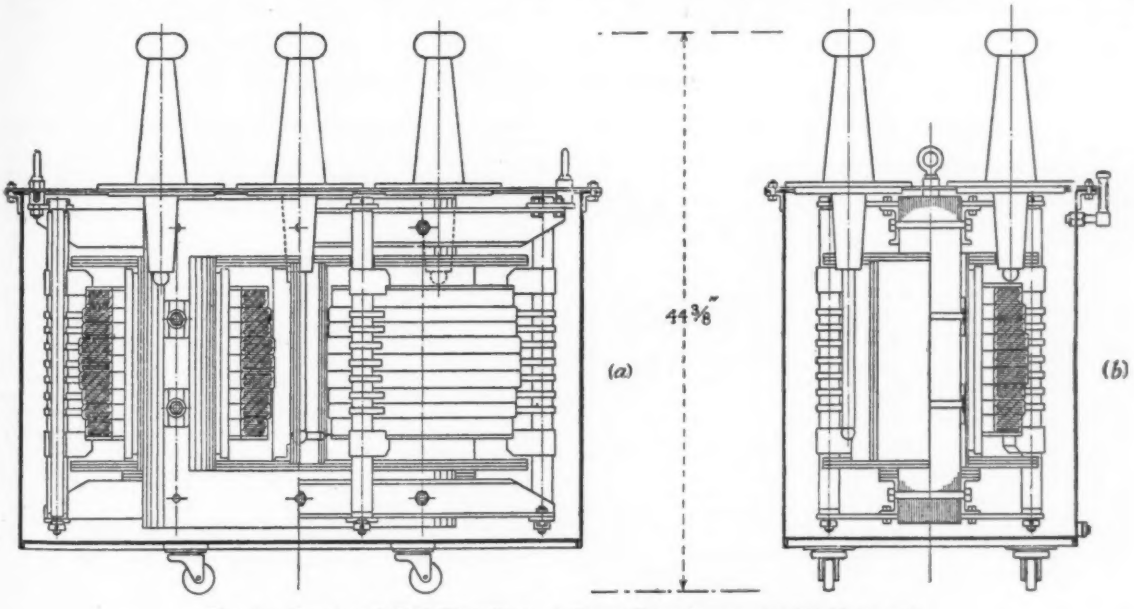


Fig. 1.—Front and End Elevations of X-ray Transformer, 200,000 V, 10 mA.

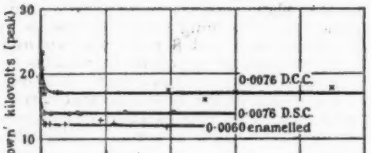
[1] R.D. Report No. 71, 1927.

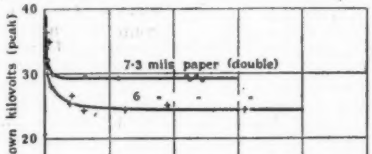
[2] British Patent No. 185,891, *Patent Office Journal*, 1922, No. 1764, p. 4872.

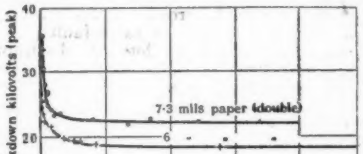
[3] An X-ray equipment for 250,000 volts (peak) has recently been made for a London hospital by Messrs. Newton and Wright, Ltd.

transformers, because some methods of winding successfully employed in the former are never used in the latter. The greatest difficulty experienced by the author in connection with insulating cylinders is to get them to withstand the axial stress to which they are subjected. This point does not assume such importance in high-voltage power transformers, since the dimensions demanded by heating and by surge conditions due to lightning automatically provide adequate clearances for the normal electric stresses. The output required of an X-ray transformer rarely exceeds 5 kVA (continuous).

Since X-ray work developed largely with the help of induction coils, it is natural that one of the commonest methods of winding their secondaries should be applied to transformer construction. Thus the Miller system is still successfully employed by some English manufacturers; the turns are wound in wax in spiral layers on a horizontal circular table which revolves on a vertical axis. That they do not make a sound mechanical job is often true, but need not be the case: a number of such oil immersed transformers, including one for 400,000 volts (peak), have been designed and constructed in the Radiological Research Department, and have been in successful operation for many years. Conceding that "wax winding" is quite unsuitable for high-temperature working, the author has no hesitation in saying that Miller coils can be produced electrically and mechanically strong for continuous oil immersion at temperatures below the softening point of wax; also it is possible to predict with considerable accuracy the size of a finished coil. To ensure good results the following requirements must, however, be fulfilled, *viz.*: (1) suitable absorbent, electrically strong, paper for interlayer rings; (2) machine-cut rings; (3) non-brittle wax with high softening temperature and good electrical properties (paraffin wax with excellent insulating properties and suitable for winding purposes can be obtained with softening point as high as 55 deg. C.); (4) accurate centreing of the paper rings on the machine table; (5) rigid specification of edge clearances and turn pitch; (6) after-winding treatment *in vacuo* at 105 deg. C., to remove surplus wax, moisture and air; (7) careful trimming to template when solid again, and final taping and varnishing with low-temperature stoving, or air-drying varnish to resist the attack of oil.







Figs. 2, 3, and 4.—Breakdown Curves of Waxed Interlayer Rings.

The method of supporting wax-wound coils adopted in the Radiological Research Department is to build a firm insulating supporting system round the *outside* of the stack, as shown in fig. 1, thus permitting a clear oil duct inside between the coils and the solid part of the main insulation. It is very difficult to dry out a transformer on account of the softening temperature of the wax; furthermore, being always cool, it cannot keep itself dry as a power transformer does. Some results of experiments on inter-layer insulation strength and the temperature-rise of wax coils (filter paper is employed for insulating rings between winding layers because of its good wax absorbing qualities, which greatly facilitate winding) were obtained with similar paper rings for wires of different sizes and insulating coverings; the general recommendations of the E.R.A. Report L/S2 were followed in the tests, and figs. 2 to 4 show the results. Tests made with paper which had not been specially dried before wax impregnation showed a breakdown value (straight part of curve) 5 per cent. less than for dried papers. This points to almost complete removal of moisture from the papers during impregnation, which is carried out at 105 deg. C. Our normal practice in the Research Department is, however, to dry the papers first in the presence of calcium chloride. It is also our practice to increase the turn-to-turn and layer-to-layer insulation of the end coils up to 10 per cent. of the total turns, grading it from triple to normal. The turns of the extreme end layers are insulated for 10 times the normal voltage. Figs. 2 to 4 show that very few paper rings suffice to provide interlayer insulation sufficient to withstand full winding voltage for designs to work at 150,000 volts (peak). Miller coils used in transformer construction at Woolwich are also subjected to X-ray screen examination before being put into service, and by this method a turn dangerously displaced from its correct position may be detected at once; such examination of certain electrical windings might be more generally employed.

(To be concluded.)

Discussion in London.

Dr. G. W. C. KAYE hoped that that joint meeting would be the forerunner of many more of its kind. The trend of development that was apparent at the Stockholm show and the recent London exhibition had been a liberal education. The self-protected tube had simplified the safety problem. The almost universal use of valve rectifiers and the disappearance of the mechanical device for high-voltage work was a striking feature; the former were unknown in the U.S.A. last year, and the latter might hold its own for d.c. work with valves priced at £20 each and having a life of 1,000 hours. The new plant at the N.P.L. had a ripple of less than 4 per cent. at full load, and it was hoped to reduce that to 1 per cent. soon. The downward tendency of voltage and the upward tendency of current for diagnosis reduced the risk of shock to the patient and improved photographic contrast. Many induction coils were still in use in this country, but they were never seen in America now; in general, transformers were supreme for X-ray work, but their hitherto optimistic ratings were valueless for continuous operation. International agreement on protective measures and also the adoption of an agreed definition of the new X-ray unit of intensity (the Röntgen) were steps forward.

Mr. W. E. SCHALL pointed out that the author's view was that of the industrial user, whereas he (the speaker) looked at the subject from the medical side. Transformers had hitherto suffered from meagre efficiency; they had to provide current for screening, for photography, and for treatment, three different sets of conditions which complicated the design problem; they could not be made to perform all three functions with equal efficiency and so they had to compromise. Induction coils remained in vogue so long as gas tubes were employed: if the former would return, as the author seemed to think, would the latter also, in place of the hot-kathode now used? Tube development was rapid, and a 60-kW tube was now available, but it had not been mentioned in the paper. Tube efficiency was less than 1 per cent., so that with such a link in the chain it was not easy to include a very efficient transformer. Medical men who could afford the space and money for transformers which would conform to power transformer design and efficiency were few and far between.

Mr. B. J. LEGGETH said that while British X-ray apparatus wanted a lot of beating, transformers used therewith would horrify commercial designers. Manufacturers' turnover did not allow much for research, and the author was fortunate in possessing facilities which radiologists dreamed of but never quite reached. Moreover, in medical circles long-term credit was expected as a matter of course. Metal-enclosed tubes were revolutionary: originally a British conception, they had enabled stereoscopic work to be done abroad. He was grateful to the author for revealing more details of transformer design than was usual.

Mr. H. B. GOUGH was of the opinion that the author's method of building transformers was too expensive for medical purposes. It was wrong to use waxed coils, because the wax would dissolve in the oil in which it was immersed in time. It was difficult to train girls to wind Miller coils (his firm held the patent at one time), which took twice as long to make as the simple assembly. They should not attempt to design so-called "safety gear," because it was always possible to touch the high-voltage leads by extending one's arm: eventually safety would be achieved along the lines of metal-enclosure.

Mr. R. S. WRIGHT explained that the Miller winding had not been adopted to any great extent, by two firms only, he thought, and it should not be confused with the "sectionalised" winding. The inefficiency of the X-ray tube was no excuse for the production of inefficient transformers. The author had described things as they had been, not as they were; in the case of induction coils, mechanical rectifiers, and transformers, wave form was of more importance than electrical efficiency, but the use of valve rectification had now made efficiency of the first importance. The author's statement ". . . whole-wave rectification by means of twice the number of valves . . ." was a slip, for while four valves were needed for full-wave rectification one would suffice for half-wave rectification.

Mr. F. E. J. OCKENDEN discussed the measurement of peak and r.m.s. voltages, which was not simple and direct except in conjunction with a spark-gap. He could not agree with the author's method of measuring current. Could not something be done with a d.c. meter and copper-oxide rectifier, or a commutator on the rectifier shaft?

Mr. C. H. HOLBEACH said that the paper stressed the high-voltage aspect, but only some 2 per cent. of the medical uses necessitated h.p., the remainder needing large current at l.p. Medical men must use their apparatus under a series of conditions, but rectification was not uniformly good at all voltages.

The value of a current stabiliser was that it not only maintained the main's pressure, but also enabled the apparatus to be pre-set, for there was hardly time to read instruments without overloading the tube. It did not suffice to rate transformers alone electrically; it must be done in combination with the rectifier system.

Mr. A. C. GUNSTONE explained that manufacturers of medical gear were not able to incur any great expense to avoid "tracking," and so they used double windings. The paper dealt largely with the Coolidge tube, whereas the industry was confining itself to the metal tube. The type of time switch referred to in the paper was not quite what was wanted, as their time was short. At a recent exhibition Belgian apparatus was on view which was declared to use one valve only for full-wave rectification. They were concerned with the effective voltage rather than the peak, and some ready means of measuring it was needed.

Mr. A. G. WARREN agreed that the effective voltage was much less than the peak when measured by a sphere-gap. If they could obtain transformer iron that would give twice the induction, it would reduce the length of wire needed and ease the design problem. The electrical gear used in association with an X-ray tube was only needed to assist the latter to produce rays, and what they wanted was a tube that would produce plenty of X-rays. He preferred resistance control of the filament to choke control.

Mr. C. M. DAVIES had experienced sludging of X-ray transformer oil, which was very difficult to remove once it got into the windings. The ventilation of mechanical rectifiers needed serious attention; spare spark-gaps should be checked each time they were used; although the kV meter was not accurate (8 per cent.), it enabled the radiographer to reproduce conditions rapidly. Interlocked control should be standardised, and contactors should be fitted with carbon arcing tips. Earthed-shield cable was the only solution of the h.v. safety problem.

Dr. ROTH, speaking as a medical man and radiologist, explained that he employed 50 mA secondary current, a Victor stabiliser, and from 30 to 33 inches tube distance. Short exposures were never required, except for chest radiography. A filament stabiliser and a synchronised stabilised timer were essential. His greatest difficulty was voltage drop, about which they should know more; the radiologist was concerned only with Ohm's law. He had discarded the auto-transformer and used primary tappings with choke control gradation.

Mr. L. G. H. SARSFIELD, in reply, admitted that medical and industrial requirements did not coincide, but thought that coil excitation might help deep penetration of metal. He had found Mr. Ockenden very helpful when obtaining instruments for special and service use at Woolwich. High-voltage design was not easy when the gear had to be of small dimensions. Waxed coils could be immersed in oil if it was suitably wrapped with tape; that was the secret.

Lieut.-Col. K. EDGCUMBE, president of the I.E.E., expressed appreciation of the presence of Dr. G. W. C. Kaye and his associate radiographers, and hoped that more joint meetings would follow.

Core-balance Protection.

Some notes on the method of core-balance leakage protection introduced by Messrs. A. Reyrolle & Co., Ltd.

A SYSTEM of core-balance leakage protection introduced by Messrs. A. Reyrolle & Co., Ltd., is designed to provide instantaneous isolation of a circuit on the occurrence of an earth fault giving rise to leakage current which may be predetermined within very wide limits. It is inoperative on ordinary overloads and has the advantage that no pilot wire is required. The fundamental principle that if there is no leakage the alegbraic sum of the currents flowing at any moment in the three conductors of a three-phase system is zero, results in no current flowing in the trip coil under normal conditions. As soon as there is leakage to earth on one of the phases, the circuit-breaker is tripped, provided the leakage exceeds a predetermined amount. Overload protection can be added to operate the circuit-breaker with or without time-limit action.

The core-balance leakage transformer used has a single core wound with three primary windings, each connected in series with one phase of a feeder, and one secondary winding connected either directly to the trip-coil, or to a relay, the operation of which completes the trip-coil circuit. Fig. 1 illustrates the method employed for protection without a relay. With a 2½-A trip-coil connected in the secondary circuit, a leakage current to earth equal to approximately 50 per cent. of the full-load current rating of the core-balance transformer will trip the circuit-breaker. With a 5-A trip-coil, tripping occurs with a leakage current equal to approximately 100 per cent. of the full-load current rating.

The scheme of connections for the method of protection with a relay is shown in fig. 2, and when this arrangement is used it is possible to arrange for tripping with leakage currents varying from 5 to 100 per cent. of the full-load current rating of the core-balance transformer. One or another of two different relays is supplied, according to the tripping range required. One is a standard relay, with its two operating coils connected in parallel, and has a tripping range adjustable by variation of the setting between 5 and 8 per cent., approximately. By connecting the coils in series it is possible to increase the range up to approximately 10 per cent. It should be understood that these are percentages of the normal current rating of the particular standard core-balance transformer used, and not of the normal loading of the circuit. The other is a variable relay with a tripping range adjustable between 25 and 100 per cent. of the core-balance transformer normal current rating. Standard transformer windings are available for 60/5.8 A, 200/5.8 A, 400/5.8 A, 500/5.8 A, and 600/5.8 A.

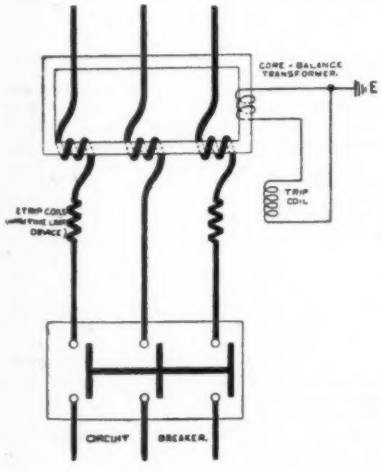


Fig. 1.

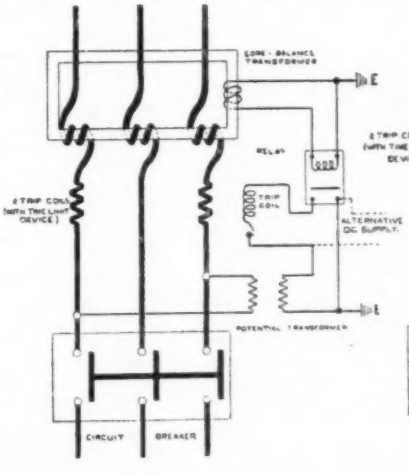


Fig. 2.

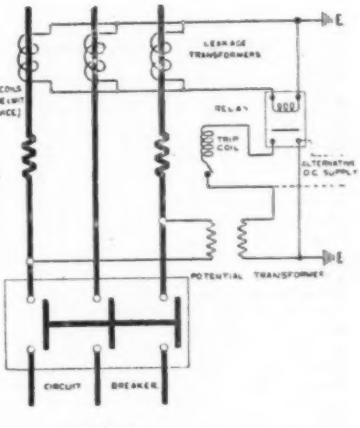


Fig. 3.

There is an alternative arrangement in which three separate wound transformers are used instead of the core-balance transformer. By using it in combination with a standard relay, settings are obtainable as with the standard relay. With an adjustable relay, a range of from 20 to 90 per cent. of the core-balance transformer rating is obtainable. Fig. 3 is a diagram showing the connections of this arrangement.

Core-balance leakage protection has an advantageous field of application in coal mines or other places where sustained arcing would be a source of great danger. It makes it possible to cut out a fault occasioned, for example, by a fall of roof, so quickly that no external arcing occurs. It is most usually installed on tail-end feeders, but it is possible to obtain some discrimination by grading a number of leakage settings, on sections in series with one another, in such a way that one nearer the source of supply will trip with a greater amount of fault-current than one further away.

A.C. *versus* D.C. Distribution.

Some of the factors underlying the relative efficiencies of alternating and direct current for town and urban area distribution.

(*Extracts from a discussion before the* LONDON LOCAL TECHNICAL GROUP *of the* ELECTRICAL POWER ENGINEERS' ASSOCIATION.)

CAPTAIN J. M. DONALDSON, M.C., who presided, opened the discussion by referring to d.c. supply as a disease, accidental perhaps, but still a disease. If one were starting to produce electricity in the simplest form one would undoubtedly produce alternating current; to make it direct current one installed a commutator, which, though a clever mechanical device, was not natural. At present a.c. was generated, and they were thus able to prevent the losses entailed in conversion, which, even with the modern rotary convertors, were not light; further, the use of rotary convertors involved expensive attendance. It might be contended that when regulations insisted upon the provision of two sources, d.c. was of advantage, in that it enabled batteries to be used as a reserve: batteries were extraordinarily expensive, however, did not last for ever, and if they were to be of any use at all they must be so big that one could not find the space for them. A change from d.c. to a.c. distribution was very difficult when one already had a considerable copper mine underground. A problem was that of dealing with single-phase motors, and the policy of his Company was generally to replace the bigger single-phase motors by three-phase motors, and its method of getting over the difficulty of using 3-core mains was to use what was practically a six-phase system.

Mr. H. BOWDEN (Hackney) urged the necessity for considering the point of view of the consumer as well as that of the supplier of electricity. From the point of view of the latter, a.c. had the advantages of cheap transformation and freedom from electrolysis; its disadvantages were power factor and metering troubles (it appeared to him that kVA measurement was much too expensive and caused no end of disputes), and shock danger. From the point of view of the consumer, the advantages were that he could obtain cheap motors and cheap transformation, but the disadvantages were power factor troubles, arbitrary speeds, shock danger, and flickering light. The advantages of d.c. supply from the suppliers' point of view were that losses were proportional to power, minimum of shock danger, cheaper metering, and the advantage of being able to deal with chemical processes without great difficulty. The disadvantage was expensive transformation. From the consumers' point of view the advantages of d.c. were that it gave him speed control, minimum of shock danger, chemical processes could be dealt with without difficulty, and losses were proportional to power. The disadvantages were expensive transformation and expensive motors. When all was considered it would appear that there was little difference between a.c. and d.c., there being a slight advantage perhaps in d.c. If one had to start a new system in an isolated urban area, with a more or less fixed load, a simple sort of a.c. system would be adopted, but there were difficulties in towns where a mixed load had to be dealt with. He did not think the advocates of a.c. could show that there was any advantage in a.c. from the point of view of the cost of the network; the problem of the amount of copper required was worked out in the text books, but only on the basis of unity power factor, and in the towns it was difficult and costly to obtain space for the installation of transformers. The argument that d.c. involved heavy wages costs no longer applied. Whilst agreeing that expensive rotary machinery was used, he pointed out that remote control enabled undertakers to dispense with operators at rotary stations. Transformers were not so economical and convenient as they were sometimes stated to be, because when varying power factor had to be dealt with it was necessary to use fancy gadgets, p.f. correctors, and so on.

Mr. J. D. SPARK (Willesden) saw no reason why an area supplied with a.c. should be at a disadvantage, compared with one supplied with d.c. The cost of cables was largely dependent upon the weight of copper in them, and it made little difference whether the cables were of 2-, 3-, or 4-core. The bugbear of power factor was counteracted largely by the lighting load, and, given careful supervision, there should be no difficulty, particularly if a tariff were adopted which took charge of power factor. In his own district there was no more trouble with the a.c. than with the d.c. consumers.

Mr. W. E. ROGERS (West Ham) agreed that up to the present the d.c. motor had had the advantage from the point of view of speed control, but pointed out that recently there had been developed an a.c. motor, details of which he hoped would be published shortly, having a minimum speed regulation of 7 to 1 with absolute squirrel-cage characteristics.

Mr. W. J. JEFFERY (Charing Cross, West End and City Electric Supply Co.) said his problem was that, having contracted the d.c. disease, how was it to be cured? It was all a matter of finance. In his Company's area there were miles of 0.1-sq. in. single-core distributors, and one could not think of scrapping all that. The only solution he could think of was to adopt a house-to-house system of high-voltage a.c. mains with local transformers; however, the value of sites in central London was very great. Recently a large consumer with a load of approximately 1,000 amperes at 200 volts was offered a.c. and replied that his building had been designed for certain purposes, so that every cubic foot of it had been allocated before the foundations were laid and no allowance had been made for transformer space.

Mr. A. F. HARMER'S experience in London was that there was very little call for speed regulation except in special cases. A method adopted in one rather congested area was to superimpose a high-voltage house-to-house distribution system with a 6,000-volt ring main run round the area from one station to another feeding point, owners of large buildings being offered a rebate of 10 per cent. if they would buy a.c. If an undertaking could afford to do that, there must be something in it.

Mr. H. W. COUZENS pointed out that those who had emphasised the difficulty of writing off the capital expenditure on mains in the event of a change-over seemed to have overlooked the fact that that had already been done with regard to the capital expenditure on generation.

Mr. GILBERT referred to the ease of transformation of a.c. In his view they must get away from d.c. supply. The difficulty of finding sub-station sites had been enhanced by the demand of the Commissioners that sub-stations should be built only on freehold property if paid for out of capital. Surely in future it must become the general law that electricity undertakings should be able to acquire compulsorily suitable sites at a reasonable cost. The use of automatic rectifiers would involve trouble as the load, their age, and their number, increased; mercury-arc rectifiers were very good in their particular spheres, but one had still to use transformers, and rectifiers cost about £4 per kW and needed maintenance, whereas with a.c. supply rectifiers could be dispensed with. With regard to the use of high-voltage local transformers, he believed that before long about 10 or 15 kW would be needed in nearly every house, and it would be necessary to have duplicate supplies down the streets. His conclusion was that in every street of about a quarter of a mile long it would be necessary to have a sub-station (preferably two, one on each side of the road) each to be big enough itself to supply the whole street.

Mr. L. R. LEE (Manchester), in a written communication, expressed the view that d.c. distribution should have been stopped by the Board of Trade at least 20 years ago. Hundreds of consumers in the suburbs of Manchester were being changed over at present.

Mr. J. H. C. BROOKING commented on the practical nature of the discussion, which set an example to the Institution of Electrical Engineers. He hoped the latter would reform and provide opportunities for the discussion of such practical matters.

Mr. F. FERNIE pointed out that in small towns and villages the cost of distributing d.c. was lower, because one could not use overhead lines heavily loaded with a.c.

Mr. A. G. HILLING suggested that the difference between the efficiencies of an undertaking generating a.c. and distributing d.c., and one generating and distributing a.c., was about 6 per cent. Very few factories used speed control. He did not believe many distributors were working to capacity, and the fact that the provision of another feeding point would almost double the capacity of a distributor was often overlooked.

Mr. BENNETT was of the opinion that the right solution was to change-over large hotels and big business buildings and to supply through high-voltage mains. If rebates were offered, a demand would be created in other buildings as well.

Mr. FOSTER said that one of the Newcastle companies which had contemplated the provision of an automatic convertor sub-station, had had to alter its plans and provide a sound-proof station at an extra cost of £2,000, owing to representations made by residents near the station.

Mr. H. BOWDEN pointed out that the latest German super-station had the whole of its auxiliary plant operating on d.c.

The CHAIRMAN, summing up the discussion, recognised that all was not gold on the a.c. side; it was more pure on the a.c. than on the d.c. side, but there were difficulties, power factor being one of them; at the same time, if it were tackled courageously it ceased to be a worry. Far less room was needed for a transformer sub-station than for any form of rotary sub-station, and transformers could be installed in the open. The rectifier was not really efficient except at high voltage and it had power-factor troubles of its own; under certain circumstances its regulation was bad, and it was also expensive. The steel tube rectifier particularly had extraordinarily complicated gadgets and the amount of space it occupied was greater than was sometimes appreciated. The glass tube rectifier had an enormous field and seemed to have advantages over the steel tube rectifier, but at present it was made in rather small sizes. As to the efficiencies of a.c. and d.c. systems, he believed the difference was greater than 5 or 6 per cent.

The Institution of Electrical Engineers.

Annual Dinners of the Centres.

Mersey and North Wales (Liverpool) Centre.

THE annual dinner of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers was held at Liverpool on November 28th. Mr. S. E. BRITTON, M.I.E.E., city electrical engineer, Chester, chairman of the Centre, presided, and the guests included numerous well-known members of the industry.

The LORD MAYOR OF LIVERPOOL toasted the "Institution of Electrical Engineers," and referred to its amazing development; it now had 13,000 members.

Lt.-Col. K. EDGCUMBE, president, I.E.E., in reply, emphasised that the well-being of the Institution depended very largely on the co-operation and activities of the Local Centres. Referring to an important jubilee in the electrical industry, it was in December, 1878, he said, that Joseph Swan invented a really successful incandescent lamp. He was helped by a man named Sterne. Since Swan's invention, progress had been very rapid in the electrical industry. At present the power load represented about 80 per cent. of the total, but 50 per cent. of the revenue came from lighting. The electrical industry was much too modest. It should use more "push" and manifest the faith it had in the commodity it was selling. Changes were taking place with regard to the different classes of members of the Institution. It was proposed to restrict the graduate class only to those who had passed the examination, and to restrict the associate class to those who had the experience, but who had not passed the examination.

Sir THOMAS WHITE (chairman of the Liverpool Housing Committee) proposed "The Electrical and Allied Industries," making brief reference to Liverpool's position under the Central Electricity Board's scheme. He believed there was a time of great success before the electrical industry, and that the brain and ability of British engineers would command the respect and the reward they were entitled to. Liverpool Corporation in 1913 had 37,000 kW of plant; to-day it had 128,000 kW. In 1913, 47,600,000 kWh of electricity was generated, and last year the total was 263,000,000 kWh. Thus, with three times the plant, it had secured five times the output. When the new Clarence Dock power station, Liverpool, was built, there would be in it two 50,000-kW sets.

In response, Mr. FREEMAN, C.B.E., said that there were very few builders of turbines, either on the Continent, or in America, who had such first-class works as those in this country.

Mr. A. E. MALPAS, Wh.Sc., M.I.E.E., proposed "The Guests," and Councillor C. C. Taylor (chairman, Chester Electricity Committee) replied, emphasising the need of more publicity to bring home to the public the utility of electricity.

Prof. F. J. TEAGO, D.Sc., M.I.E.E., proposed "The Chairman," and Mr. S. E. BRITTON replied by stating that his two hobbies were the development and utilisation of water power and rural electrification. Since 1866 ten commissions and committees had been set up to report on the use of water for power purposes. Those committees had produced 28 reports, but nothing more seemed to have been done. In view of the widespread unemployment it was distressing and disappointing that the Government was neglecting to utilise water resources.

Mr. O. C. WAYGOOD, hon. secretary of the Centre, was cordially thanked for the work he had undertaken in arranging the dinner.

During the evening the chairman announced that the Benevolent Fund golfing competition for the Dennis trophy had been won by Mr. W. Kirkham, who, in due course, would receive a replica. The golf competition realised £33, and that would be handed over to the Benevolent Fund.

North-Eastern Centre.

The annual dinner and reunion of the North-Eastern Centre was held at the Central Station Hotel, Newcastle, on November 27th, and attended by about 150 members and guests.

Mr. HUGH PATERSON, in proposing the toast of "The Lord Mayor and Corporation of Newcastle and the Mayor and Corporation of Carlisle," said it was lamentable that every year 880 tons of filth and soot were deposited on each square mile of Newcastle. The city could be made the cleanest in the country by the universal use of electricity. He congratulated the civic leaders upon the thought and foresight that had induced them to embark upon the great North-East Coast Exhibition.

The Deputy Mayor of Carlisle (Councillor J. HENDERSON), in response, said that if anyone could revive the industries of the North-East Coast it was the present civic authorities of Newcastle. He hoped that the Exhibition of 1929 would be as highly successful as was the Pageant of Carlisle.

Mr. M. S. GIBB, in proposing "The Institution of Electrical Engineers," said that the Institution took its place in the front rank of such organisations. On the North-East Coast they had been led to believe that they would get cheaper electricity as the result of recent schemes, but so far they had waited in vain. They appreciated that schemes of such a magnitude took years to develop, but he wished, however, that the industries of the area could derive *some* benefit from the schemes. He thought that, owing to its natural position near the coalfields, and the fact that it had a progressive electrical industry in the area, the North-East Coast should have much greater advantages regarding the cost of electrical energy than other areas. They had to reckon in the near future with the chemists, who were particularly busy in the North-East just now.

Lieut.-Col. K. EDGCUMBE, in reply, referred to the associations of Newcastle with the early development of the incandescent lamp, and said it was in that city that Joseph Swan first showed a practical incandescent lamp; that was 50 years ago. They would thus see that from the first Newcastle was a pioneer in matters electrical. Although they had got the idea that power was the great outlook for electrical energy, more could be done than at present to increase the domestic consumption of electricity. It was a question of convincing the public that electricity was "the thing." There were indications of increased consumption on the North-East Coast, at Sheffield, and at Glasgow, and he hoped it meant that the shipbuilding and steel industries were on the mend. The development of electricity had shown what could be done by scientific methods, for there had been an immense increase of efficiency in the last few years.

"Our Guests" was toasted on the call of Mr. B. A. Robinson, and Mr. A. B. E. Blackburn responded. A similar compliment was paid to the chairman.

South-Midland Centre.

There was a large attendance at the annual dinner of the South-Midland Centre of the Institution in Birmingham on Friday last, when Mr. S. Holden presided.

Mr. FRANK HODGES, of the Central Electricity Board, submitted the toast of "The Institution." Its members, he said, had in past years made a wonderful contribution to the knowledge and needs of mankind, and there had been amongst them men whose names would rank among the immortals in the world of applied science. The idea of a National Board and the inter-linking of generating stations did not emerge from the political mind, but from the technical and engineering mind. Although there were engineers who might feel grievances in certain respects, he hoped they would not cherish them for long, because of the operations of the Board. He praised those men who considered it to be in the interests of the nation that electricity should be regarded henceforth from a national rather than from a parochial standpoint. When the history of this national conception came to be written, the Institution would take a prominent place. The Board had a vast reservoir of ability to draw upon when it came to appoint men—from Mr. Archibald Page (chief engineer) right down to the lowliest officer in the hierarchy of the Board—and it was a very difficult task to make the appointments. The Board was delighted to have Mr. S. T. Allen as district engineer in the Midland area.

Mr. P. V. HUNTER, vice-president of the Institution, replied, and expressed admiration for the operations of the Central Electricity Board. In all the contracts which the Board had placed, it had not ordered a single piece of equipment outside this country. No political considerations had had any weight with the Board in the placing of contracts.

Mr. G. VERITY gave the toast of "Kindred Societies and Guests" in a humorous speech, and the BISHOP OF BIRMINGHAM, in reply, said some of the deepest thinking in the world was now being given to the science of which those present represented the practical application.

Scottish Centre.

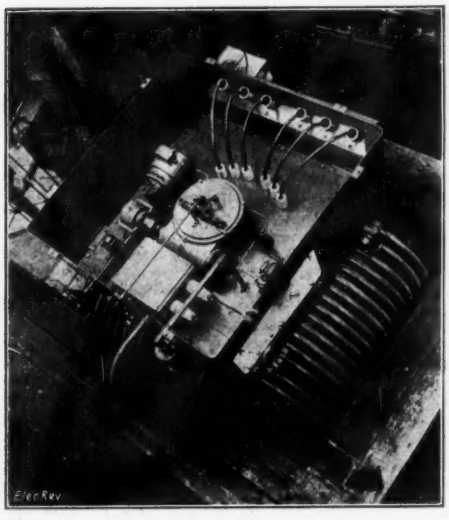
The Scottish Centre of the Institution held its annual dinner and "at home" on November 27th, at Glasgow, a large gathering being presided over by Mr. D. S. MUNRO, chairman of the Centre. Mr. J. R. RICHMOND proposed the toast of "The Institution." The electrical industry, like all others, was at the beginning of great changes, both as regarded its technical development and industrial structure. Rationalisation deeply affected their industry, and in the economic side of hydro-electric schemes, and also that more recent development, marine electric propulsion, in which they in Glasgow were specially interested. Captain J. M. Donaldson, M.C., vice-president of the Institution, acknowledged the toast, and the health of the chairman was pledged on the call of Mr. D. MACFARLANE MACLEOD.

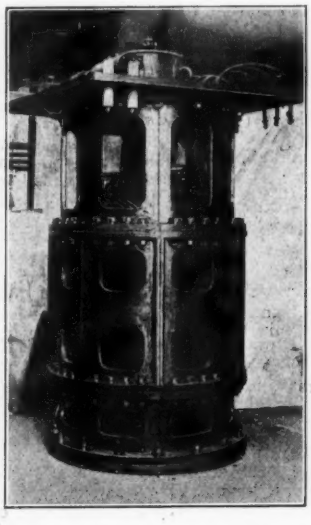
New Electrical Devices, Fittings, and Plant.

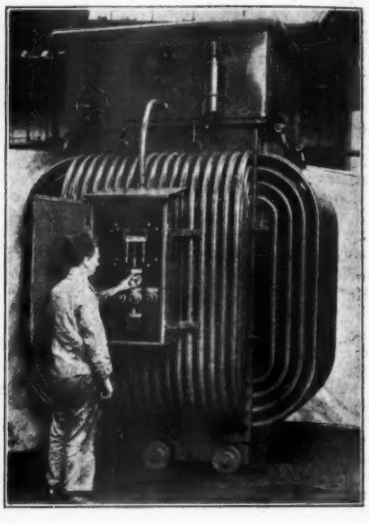
Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Large Induction Regulator.

There has just been shipped to New Zealand a large induction regulator which has several interesting features. It has been designed and manufactured by Messrs. SWITCHGEAR AND COWANS, LTD., Old Trafford, Manchester, and supplied to the order of the New Zealand Government for the Gisborne substation of the Waikaremoana power scheme. The pressure of the incoming supply circuit controlled by the regulator varies from 10,000 V to 13,000 V (three-phase, 50 cycles, 3,500 kVA), the outgoing circuit being regulated to maintain a constant pressure of 11,000 V, with plus or minus 12½ per cent.







Figs. 1, 2 and 3.—Large Induction Regulator, 3,500 kVA; Top Plate, Regulator Proper, and Complete Unit, respectively.

variation. The regulator functions in 45 sec. from maximum to minimum boost, the rotor being driven by a 12½-h.p. motor running at 1,420 r.p.m., and driving the rotor through pinions and worm gears, the latter being immersed in oil baths. The top-plate of the regulator, showing the motor and gearing and arrangement of terminals, is shown in fig. 1. The wound rotor and stator are designed with oil cooling ducts. The rotor flexible leads to the terminals are supported on a stout steel spiral spring encircling the shaft, which removes all stresses from the terminals and joints at the ends of the leads. The end windings of the stator are permanently retained in position by insulated bracing rings, to which each coil is individually secured, thus preventing distortion due to stresses in the event of short-circuit. The regulator withdrawn from the oil tank is shown in fig. 2. The control panel is mounted on the side of the tank as shown in fig. 3, which also shows the emergency hand wheel, oil filling valve, and oil gauge, and also a breather which prevents moisture getting into the oil. The regulator is of the outdoor type; it is probably the largest two-pole regulator that has been made, and is believed to be the largest induction regulator of any type yet installed in New Zealand. The approximate dimensions of the apparatus complete are 11 ft. high, 9 ft. long, and 7 ft. 6 in. wide. The weight complete with oil is approximately 12½ tons, and the weight of oil required to fill the tank is three tons.

A Continuous Playing Gramophone.

An Australian invention, for which CONTINUOUS GRAMOPHONES, LTD., 13, Queen Street, E.C.4, have acquired the world's rights embodies, it is claimed, the only really continuous playing gramophone in existence. Up to 36 records (10-in. or 12-in.) can be placed indiscriminately at one time in the record carrier, and the machine will play the whole of them throughout and switch off the machine when the last record is played. Having played a record it replaces it in its original position, during which process the old needle is automatically discarded, and a new needle is brought into position ready for playing the next record. By pressing down a small lever any one record can be repeated indefinitely. A universal motor is fitted, suitable for a.c. or d.c. and for any ordinary voltage, but it is used only to turn the record whilst it is being played: the moment that the playing of the record is finished the motor is automatically switched off, and the momentum of the turntable sets in action the mechanical movements which replace the record in its proper position in the magazine, take a new record from the magazine and put it on the turntable, meanwhile changing the needle; the last mechanical operation is that which again brings into action the switch and starts the motor for playing the next record.

A H.p. Testing Transformer Set.

To meet the necessity for a simplified and portable h.p. testing transformer set, Messrs. G. DIKKERS & CO. (ENGLAND), LTD., Avenue Chambers, Southampton Row, W.C.1, are marketing a range of instruments similar to that shown in fig. 4. An important feature of these sets is that they include an induction regulator, with a handwheel, whereby the voltage can be raised from zero to the maximum, thus obviating the disadvantages of auto-transformers. Two small loose-handle circuit breakers are fitted in place of fuses, and the front panel, which is shielded from the h.p. terminals, also carries a voltmeter reading high pressures directly, and also a pilot lamp. The whole forms a very compact outfit of minimum weight and dimensions suitable for works testing of switchgear and electrical equipment generally. The apparatus is claimed to be easily adaptable for testing the dielectric strength of transformer and switch oils by fitting a standard oil bath with a spark-gap attachment. The sets are designed

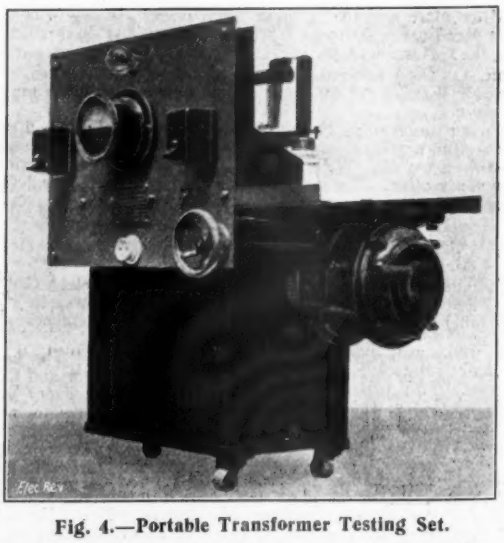


Fig. 4.—Portable Transformer Testing Set.

suitable for single-phase supply, and they may be worked off phase and neutral on a three-phase system. The following range of maximum h.p. test voltages can be supplied either with one terminal permanently earthed, or both terminals insulated: 6,000, 10,000, 20,000, 35,000, and 50,000 volts.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Hot Spots in Transformers.

So far as Mr. Norris's opinion is concerned, it appears that the British Standard Specification might as well be thrown away. As the advice which I have been privileged to give on various occasions has not fulfilled his gloomy prognostications, he is wrong on the facts, but it has occurred to me that we may be talking at cross-purposes.

Let me explain that the best practice in designing transformers is to afford the greatest facility for dissipation of the heat from (core and) windings to the oil as compared with the ensuing dissipation from the outer surface of the tank. This is ensured by, among other things, allowing ample unrestricted oil ducts, and particularly by using a liberal section of copper. The resulting sturdiness enables not only the rated load to be carried with ease, but such diversity of load as is met with in actual operation to be safely withstood. As the Hackbridge designs are invariably of this nature, it explains why I took this for granted. Transformers designed for the domestic load referred to by Mr. Norris would, of course, be designed for the worst, *i.e.*, highest air temperature conditions, and one does not expect, nor did I suggest, that with a lower air temperature, the transformer should necessarily be loaded up to 90 deg. C. oil temperature, but I distinctly stated that the B.S. rating was not intended as a basis of maximum loading. I have not yet met the mains engineer who uses his transformer as an oil-immersed fuse. Further, even if such a transformer were installed in Spitzbergen in winter, excessive load would be prevented from damaging the transformer *and* other apparatus in circuit by the usual oil switch with overload trip coils, although such practicalities seem below Mr. Norris's notice.

In other words, transformers should be designed for actual use, and not to scrape through the test requirements, with an indicator to show subsequently what mere percentage of their load they can carry under actual operating conditions. It is not kind to keep sub-station engineers awake o' nights wondering . . .

Now it is possible, by contrast to the above methods, to achieve a certain economy in manufacture by (to take a rough example) putting what I should call a 500-kVA transformer into a larger tank, when it might even pass test and be legitimately described as a 750-kVA transformer. The generation of heat in conductors increases as the square of the current density, and by thus increasing the density 1.5 times, the heat produced per lb. of copper will be 2.25 times as great. (On the other hand, a low core loss would be shown because of the smaller frame, but the advantage is dearly bought.) In such a case, a winding temperature indicator, and even a hot spot indicator, may well be advisable in actual operation. It may be that I have misunderstood Mr. Norris's viewpoint—regretfully, for his statements would be agreed to by me for such an example. In extenuation I would explain that I am accustomed to greater liberality in design than is perhaps strictly necessary, and my opinion is that merely "good" thermal design is not enough, one must take a broader view.

Mr. Norris's zeal has outrun his discretion when he states that an indicator is called for on every 132-kV transformer ordered by the Central Board, for it is perfectly obvious that, were these instruments fitted in accordance with his theories, they would also be fitted to the Board's 33-kV transformers, which are subject to the same conditions of loading. As the Hackbridge Company is the only maker who has been awarded an order for the 33-kV transformers, I am in a position to say that such indicators are not specified on them. The reason, I imagine, that they are wisely specified on the former is that British experience on the more heavily insulated windings has of necessity not been copious, and so it is desired to ascertain actual data on them. Moreover, what the Board requires to be measured is, in its own words, "the highest temperature within the winding," precisely the expression which I have used in contradistinction to hot spots, which the eminent engineers in charge of the Scheme surely do not anticipate. The best method of ensuring ability to carry load is to rely on existing real experience, as in the case of the 33-kV transformers above, which is amply sufficient, moreover, since simple designing ability may be assumed to be on a parity in first-class firms, the comparative weight of active material used in construction affords a valuable indication. Although I would not suggest hampering a designer by specifying a maximum value of current density to be employed, a knowledge of the section of copper which various tenderers propose for their own products will give an approximate indication of their comparative loading capabilities, and will be better than any temperature indicator, since the value shown will be embodied in the active material and thus be intrinsic.

I fear, Sirs, that a considerable digression has been necessary in view of the matters raised by Mr. Norris, which, although irrelevant, must be dealt with to avoid misconception, so I will now return to the point, *viz.*, "hot spots."

It will be recalled that the advertisement to which he objects stated that the advertisers' transformers were designed and constructed without "hot spots." Logically, Mr. Norris's objection letter must have been due to one of two causes: (*a*) He ascribes an incorrect meaning to the common expression "hot spots," in which case his letter should be withdrawn; or (*b*) he considers that transformers should be made with "hot spots."

Now the words "hot spots" have been used for at least the last eighteen years, to my certain knowledge, to describe abnormal and harmful localised heating in electrical windings, and they have occurred in numberless purchasers' specifications. If Mr. Norris uses the expression now to mean something entirely different, he has only himself to thank for any confusion resulting. The advertisement and my letter referred only to "hot spots," and I refuse to be drawn into a discussion on any other kind of spot. My final word on the subject is this: Mr. Norris says that certain conditions of loading may be dangerous to a British Standard rated transformer. I go further, and emphatically state that unless a transformer is designed and made without hot spots, for all practical purposes it is dangerous under any condition of loading, and at any oil temperature. Hence the anti-hot spot advertisement.

William C. Kennett.

Walton-on-Thames, *November 27th*, 1928.

Transformer engineers are watching with considerable interest, and no little amusement, the controversy between Messrs. Kennett and Norris. These gentlemen are well able to keep their respective ends up without outside assistance, and one therefore hesitates about butting in. The average Englishman, however, likes to see fair play, and on these grounds I would like to draw attention to Mr. Norris's assertion that "considering a 250-kVA British Standard rated transformer of good thermal design . . . when the surrounding air temperature is 15 deg. C. If the oil temperature were allowed to reach 90 deg. C., the load on the transformer would be somewhere between 400 and 600 kVA." This statement, as it stands, is meaningless. If Mr. Norris intends to say that a *continuous* load of 400 to 600 kVA is necessary, the statement is definitely incorrect, except possibly in a transformer having a "freak" distribution of losses. If Mr. Norris does not intend to imply a continuous load, his statement is valueless, for the load might even be 1,000 kVA or more—for a short period—without approaching anything in the neighbourhood of 90 deg. C. in the oil.

In order to check Mr. Norris's statement, I have calculated, on a recognised basis, what continuous load would really be necessary to raise the oil temperature of a transformer to 90 deg. C. with surrounding air at 15 deg. C. I have used for these calculations two single-phase and two three-phase 250-kVA, 6,600-volt, commercially designed transformers with a normal distribution of losses (average copper/iron at 15 deg. C. being 1.91). In these four cases the percentage overloads come out, respectively, to 25, 26, 26 and 27—that is, an average of 315 kVA. In making these calculations two assumptions have been made, namely (1) that the average temperature of the copper with the oil at 65 deg. C. is 5 deg. higher, and (2) that the average temperature of the copper with the oil at 90 deg. C. is 10 deg. higher. The former of these is laid down in the B.E.S.A. Regulations, and is borne out in practice for transformers having reasonable densities. The latter assumption can hardly be too high, and if it be contended that it is too low, the only effect will be to reduce somewhat the figure of 315 kVA.

Admittedly an overload of 26 per cent. is too high a continuous load for an ordinary commercial transformer, but my aim is to show up the fallacy of Mr. Norris's statement and the unfairness of making loose, unqualified, and misleading assertions.

In conclusion, may I point out that no type of indicator can ever be an insurance against wilful and stupid overloading of transformers. In order that my employers shall not be saddled with my private opinions I am obliged to conceal my identity under the nom-de-plume of

Designer.

November 26th, 1928.

Foreign Contracts.

In reply to your three readers who commented on my letter, let me point out that I did not write particularly to raise the very large question of Free Trade *versus* Protection, but to point out the curious omission of one vital consideration from the case for "safeguarding," as put by several prominent advocates, such as Sir Henry Page Croft.

Before touching on their views (if your space will allow me) I must protest strongly against Mr. Pain's opening: "Why does Mr. Griffiths put his own country last?" This remark is most unjustified, and begs the whole question. The Free Trader is such precisely because he believes, doubtless wrongly in Mr. Pain's opinion, that Free Trade is the best for his country's well-being, and I resent the offensive assumption of a monopoly of patriotism by those who believe the opposite. And your last correspondent, too, might be surprised to hear that Free Traders are also "taxpayers."

As to the contention that home trade will replace the foreign trade, we must all form our own opinions. Apart from the rise in price (in general) of the safeguarded goods, which by

itself will have important consequences, there will be numberless other repercussions, and I will only say now that I do not for one moment believe that home trade will fill up the gap in the gratifying and convenient way your correspondents suggest.

Briefly, I believe that these things automatically and inexorably settle themselves to the nation's best advantage when left alone, and that all attempts to constrain and manipulate them by subsidies, tariffs and preferences only injure the country on balance. The very lists of protectionist Continental countries, with their low wages and standards of living, enumerated by the "safeguarders" themselves in the *Telegraph* supplement, help to strengthen my conviction that, bad though things are here through many well-known causes, "safeguarding" would not help.

Mr. Pain's statement that I "wish to exclude" the wire contract from my arguments shows very careless reading. What I said was that I "am not commenting" on it. This was written simply in order to emphasise that I was concentrating on one subsidiary passage in Mr. Bolton's letter as an apparent illustration of the one point raised by me.

A. O. Griffiths.

November 26th, 1928.

[We regret that we are compelled to close this "Correspondence," as we have not space to spare at the present time for discussion of the general question of "Free Trade *v.* Protection."—EDS. ELEC. REV.]

Unemployment.

Your leader in the issue dated November 23rd is welcome, and certainly no reader—unless hopelessly blinded by political partisanship—can find fault with the views expressed.

No political party can cure unemployment. The State can only inject a transitory anæsthetic into the distressed section of the body politic. The cure (and cure there is) must come from within, *i.e.*, from industry itself. As long as British industry retains the ideas of organisation that were current before the war, so long will there be unemployment as we have it to-day.

Rationalisation—the idea—born, so to speak, in the Ruhr in 1923-24, is the real cure. Safeguarding—de-rating—and any other political "ing" can only touch the fringe of the problem. Rationalisation, on the other hand, spells, *inter alia*:—

(*a*) Economic financial grouping (*vide* the recent electrical mergers).
(*b*) A much higher degree of mechanisation than we to-day possess in our workshops and mines.
(*c*) Enrolment of labour *pro rata* to actual—not hypothetical demand.
(*d*) The employment of that labour full time—not short time or overtime.
(*e*) Sane co-operation between competitors—through, if need be, their Associations (instance, B.E.A.M.A.)—to ensure steady—not violently fluctuating—industrial output to meet the demand of the home market.
(*f*) Utilisation of the major proportion of profits to increase factory efficiency, and thereby lower costs still further.
(*g*) The complete rejection of rings formed to curtail output for the purpose of keeping prices up to a predetermined standard.
(*h*) Effective standardisation.

These desiderata are not the vague imaginings of a lunatic. They have actually been achieved in Germany, as anyone interested can discover.

Low prices increase purchasing power, and therefore demand, and this in turn results in an absorption of unemployed labour.

Thousands of miners were thrown out of the Ruhr coal-mines alone between 1924 and 1927; yet owing to low-priced products resulting from rationalisation, the greater proportion of this labour is now absorbed in other directions.

Rationalisation is non-political. A section of the politically-minded will certainly shout "but this is nationalisation"! It isn't. Nationalisation in prospect is a fair dream. In actuality it has proved to be a mad nightmare.

It would serve a great purpose if, through the medium of your columns, the logical mind of the electrical community could be induced constructively to attack this vital and calamitous problem of unemployment. The problem is stupendous—granted; but individuals produce leaders—and leaders a school of thought. A new school of thought is required to solve the unemployment problem. It must derive its inspiration from *within* the industry, not from some vague political philosophy, which changes with every change of attitude of a vacillating electorate.

R. C. Anderson.

London, *November 28th*, 1928.

Peak Load Control.

Mr. H. Wilson will be interested to learn that a pilot wire system for controlling street lamps and water heaters has been in use in Southend for several years. So far it has been used only for street lighting, consisting of 1,300 lamps, and it has shown that the incorporation of a small pilot wire in the street mains at a trifling cost does effect important economies in street lighting costs.

The system differs considerably from that described by Mr. Wilson in the ELECTRICAL REVIEW of November 16th, in that each lamp or heater is fitted with a series type relay supplied by Messrs. Chamberlain & Hookham, Ltd., and the pilot wire is used for connecting the relay coils in series across the main at the control station and the neutral at the far end of the pilot-wire circuit. When the relay coils are de-energised, the switches in the lamps "make," whereas those in the houses "open."

The system in use in Southend, while it requires the use of a relay for each street lamp, offers several important advantages.

1. An open circuit or "earth" on the pilot wire automatically lights up the street lamps and switches off the heaters, so that the streets are not liable to be plunged in darkness during lighting-up hours, and the heating load will never occur on the station peak load.
2. Several classes of lamps (dusk to 11 p.m., dusk to dawn, and 11 p.m. to dawn) are operated by means of one pilot wire.
3. The relay, being of the series type, does not require a transformer. It is of quite small dimensions, and can be inserted in the switch casting generally used on lamp columns.
4. The pilot wire only carries the current required for operating the relay, and a wire of 0.002 sq. in section is sufficient.
5. The relay's consumption is less than half a unit per 1,000 hours.
6. The supply pressure to the street lamps is normal, whereas with systems making use of special wires for street lighting, the pressure at the end of such wires is often very low.

A. C. Johnson.

Southend-on-Sea, *November 26th*, 1928.

London's Electricity Supply.

I should like to bring to public notice the undermentioned case of restricted supply, which shows a deplorable state of affairs, especially when on all sides the greater use of electricity is being urged on the public in general: A consumer within six miles of London Bridge applied to the supply company for terms, &c., for electric heating, and received the reply that the existing supply voltage of 100 was only possible and 2 kW only available—a pretty hopeless proposition! When will the supply company wake up to the necessity of being able to meet all reasonable requirements?

Disgusted.

London, *December 1st*, 1928.

Electromagnetic Forces.

Your correspondent, Mr. W. F. Dunton, has set up the same bogey in a new dress and knocked it down once again. We are no longer amused.

E. B. Wedmore.
H. Trencham.

London, *November 30th*, 1928.

[This correspondence is now closed.—EDS. ELEC. REV.]

Reorganisation and Staff Displacement.

It is my misfortune to have a good memory, hence I could counter every statement made with another. I hate attacking the team, but when a man wins through according to a code and the team lets him down, strange things happen. The Board of Trade regulations have made the power-house men all-powerful in office hours; this prevents appreciation and creates opposition for any who know more at other times.

The Central Displacement Committee is an official body, and the official mind will only help the down and out. There is a simple solution to the problem—start two lists: (1) Undertakings which will accept one, two, or three men in the next five years from power-house staffs; (2) men who are *qualified* to accept substitution berths. This scheme must cover *all* men in grades which are liable to be reduced in numbers, for many men in approved stations have qualified to move, and their posts could then be given to others who have not troubled to qualify. This would lead to justice rather than the unpractical and unconscious form of favouritism which seems so prevalent at present.

The weakness of all present schemes is that the men in the intermediate positions will not give the push which only they are able to give.

Many thanks, Messrs. Editors, for allowing the prisoner-at-the-bar to speak. I am like the captain of a ship signalling for a pilot to bring his valuable cargo into port.

Y. Z.

December 1st, 1928.

"New Art" Fittings.

With reference to your report on the second E.D.A. conference, I am sorry I was unable to accept the E.D.A.'s invitation to be present, if only to take up the defence of fittings manufacturers, few of whom "understand line form and colour as required to-day." I heartily agree with one of the

speakers in the discussion who says "after all, they have done a great work in educating the public."

Looking at the matter from a purely business point of view, what fittings manufacturer of any standing at all could possibly hope to sell his goods if they were not to the public's taste? And surely we must give the public credit for being able to understand form and colour. There is undoubtedly a great demand for the "New Art" type of fitting, as Mr. Young says; we have been supplying whole installations for hotels, theatres, and restaurants for the past three years, and the demand is growing. Undoubtedly, here is a profitable form of business, both for manufacturers and the supply companies, provided it is treated in the correct manner. And who is better qualified to do this than the manufacturer himself? Surely most fittings manufacturers of repute must give their utmost attention to design, or why do they exist?

In conclusion, I do not think there need be any fear of "New Art" designs being ridiculed, as evidence our own steady increase in output of fittings of this type for the last few years is fairly conclusive.

W. Harvey.

London, *November 26th*, 1928.

Earthing, Wireless, and the I.E.E.

All genuine installation engineers must, I feel sure, have read Mr. R. H. Rawll's able articles, published in your issues of March 30th and November 30th of this year, with a keen sense of appreciation, but the author referred to does not explain why so many glaring cases of danger are to be found to-day. I submit that the basic fault lies mainly with supply authorities which have almost universally allowed themselves to be run and controlled by non-technical clerks, with no training or experience whatever. In connection with wireless I will vouch for the following: This year I had occasion to visit a relative lying in a large London hospital; I found the victim on a standard iron hospital bed, resting on a beautifully clean conductive floor. Within easy and deliberate reach of the patient's right hand was a two-pin light plug point with three yards of most shoddy flexible terminating at a metal clip on a reading lamp, with an unbushed leading-in hole for the very frayed flex. Also, some kind donor had equipped the ward with wireless, the headphone flex being plugged into a socket connected to the general wireless distribution system of the hospital. The wiring for the latter was neatly carried out in lead-covered wire, earthed, all being most handily arranged to be reached by a patient in the bed. Why? In the name of the Regulations for the Electrical Equipment of Buildings!

Recently I found myself sitting at dusk in a book-case alcove in the library of our Institution. On the table at which I was seated was a very useful type of metal reading lamp, with a yard or two of ordinary flex connecting it to a two-pin wall socket, the whole being adjacent to and within easy reach of the earthed hot-water radiator. I wonder which member of the Council is responsible.

W. E. Rogers, A.M.I.E.E.

London, *December 2nd*, 1928.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1927.

12,311. "Light-sensitive electric devices." J. L. Baird and Baird Television Development Co., Ltd. May 7th, 1927. (300,183.)

12,717. "Sparking plugs." G. Holroyd. May 12th, 1927. (300,289.)

15,313. "Electrically-wound clocks." Sangamo Electric Co. October 4th, 1928. (278,314.)

17,912. "Annealing and other furnaces, muffles, and the like." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. July 6th, 1927. (300,293.)

17,961. "Electric arc welding apparatus." O. Schuchmacher. July 6th, 1927. (Convention date not granted.) (274,086.)

18,130. "Electrical control systems comprising switches and relays." Electric Control Co., Ltd., and O. Ellefsen. July 8th, 1927. (300,295.)

19,904. "Electric fuses." C. W. Cox and C. E. C. Shawfield. July 27th, 1927. (300,160.)

20,002. "Picture and the like telegraphy." G. M. Wright and S. B. Smith. July 27th, 1927. (300,148.)

20,500. "Selective electric relays." Dr. P. Meyer Akt. Ges. August 6th, 1926. (275,630.)

20,774. "Electric control switches for high-tension cables." F. Berg. August 6th, 1927. (300,152.)

20,789. "Irradiating devices." Quarzlampen Ges. August 12th, 1926. (275,979.)

20,804. "Electric transformers." G. M. Wright. August 6th, 1927. (Addition to 271,950.) (300,154.)

20,805. "Holders for electrical apparatus." F. G. Hunt. August 6th, 1927. (300,155.)

20,857. "Electric signalling systems." General Electric Co., Ltd., and C. E. Cutting. August 8th, 1927. (300,223.)

21,162. "Variable electric inductances." B. Hesketh. August 11th, 1927. (300,305.)

21,187. "Electrical transformers, particularly those for use in wireless telegraphy and telephony." E. A. O. Viel and J. Amiot. August 11th, 1926. (276,003.)

21,210. "Telephone systems." Associated Telephone and Telegraph Co. August 26th, 1926. (276,656.)

21,266. "Conduits or ducts for electric cables." Callender's Cable & Construction Co., Ltd., and P. V. Hunter. August 12th, 1927. (300,307.)

21,293. "Electric motors and control systems therefor." L. Miller and Metropolitan-Vickers Electrical Co., Ltd. August 16th, 1927. (300,315.)

21,785. "Electric switches and control mechanism particularly suitable for railway signalling apparatus." British Power Railway Signal Co., Ltd., S. L. Glenn and E. E. Pierce. August 18th, 1927. (300,317.)

21,881. "Electrical turning-gear for starting internal-combustion engines." F. H. Royce. August 19th, 1927. (Patent of addition not granted.) (300,320.)

21,943. "Means for attaching or securing electrical conductors, cables, or the like to walls or other supports." Macintosh Cable Co., Ltd., and D. R. F. Milner. August 20th, 1927. (300,323.)

22,115. "Safety device for electrically-driven vehicles." W. A. Stevens. August 23rd, 1927. (300,326.)

24,582. "Switch device for electrically-heated apparatus and the like." E. Meier. September 19th, 1927. (300,347.)

25,281. "Electric terminals, couplings, and the like." C. R. Cook. September 24th, 1927. (300,353.)

25,489. "Microphones and like devices." De Forest Phonofilms, Ltd. October 29th, 1926. (279,806.)

25,968. "Electric motor-control systems." General Electric Co., Ltd., and W. J. Paddock. October 1st, 1927. (300,363.)

27,037. "Electric cables." Siemens Bros. & Co., Ltd., and H. M. Mathiesen. October 12th, 1927. (300,368.)

27,333. "Electric switches." Butler's, Ltd., and A. Reeves. October 14th, 1927. (300,371.)

27,430. "Devices for rectifying and smoothing alternating current." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 15th, 1927. (300,372.)

28,206. "Multi-way conduits for electric conductors." Callender's Cable and Construction Co., Ltd., and C. F. Whitehouse. October 24th, 1927. (300,377.)

29,293. "Battery eliminators for use with wireless apparatus." R. M. Ellis and P. W. Baker. November 2nd, 1927. (300,383.)

30,168. "Electric remote control devices." Siemens & Halske Akt. Ges. November 11th, 1926. (280,562.)

30,177. "Controllers for electric motors." N. L. Mortensen. November 10th, 1926. (280,562.)

31,575. "Signalling devices." Electroflo Meters Co., Ltd. (Republic Flow Meters Co.). November 24th, 1927. (300,397.)

31,637. "Concrete electricity transmission line masts." British Insulated Cables, Ltd., and A. E. Perkins. November 24th, 1927. (300,399.)

32,839. "Thermionic valves or electron discharge tubes." S. R. Mullard (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). December 5th, 1927. (300,403.)

35,230. "Electric insulators." R. Haddan (Steatit Magnesia Akt. Ges.). December 29th, 1927. (300,419.)

35,485. "Devices for attaching hangers or bolts to electric insulators." Steatit-Magnesia Akt. Ges. October 18th, 1927. (Addition to 285,453.) (298,970.)

1928.

1,799. "Electric heating machines, such as rivet heaters." International General Electric Co., Inc. January 19th, 1927. (283,905.)

3,451. "Electric switches more particularly for battery lamps." E. Schmidt. February 3rd, 1928. (300,433.)

7,276. "Electromagnetic railroad switch-operating devices." A. C. J. Guenee. March 11th, 1927. (286,728.)

7,371. "Screens for light projecting lamps." H. Haddan (Auto Deflector Co., Inc.). March 9th, 1928. (300,448.)

7,616. "Safety electric switches." Siemens Schuckertwerke Akt. Ges. May 16th, 1927. (280,595.)

7,984. "Filter for preventing distortion of currents of telephonic frequencies." Soc. des Téléphones Grammont. March 26th, 1927. (287,847.)

8,071. "Electric switch mechanisms." British Thomson-Houston Co., Ltd. March 25th, 1927. (287,561.)

8,383. "Containers for electric accumulators." Concordia Elektrizitäts Akt. Ges. and W. Gosmann. March 19th, 1928. (300,451.)

8,634. "Electric resistances." H. A. Gill (Steatit Magnesia Akt. Ges.). March 21st, 1928. (Convention date not granted.) (Addition to 286,720.) (295,370.)

8,637. "Magneto-electric machines." F. Quast. March 21st, 1928. (300,452.)

9,938. "Alternating current magneto-electric machines." F. Quast and A. F. V. Eichert (trading as Berko-Werke Quast & Co.). December 24th, 1927. (300,457.)

10,023. "Device for the control of the level of the electrolyte in accumulator batteries." Soc. des Accumulateurs Electriques (Anciens Etablissements A. Dinin). July 13th, 1927. (293,825.)

13,039. "Treating of filaments for vacuum tubes and the like." British Thomson-Houston Co., Ltd. May 3rd, 1927. (289,837.)

13,680. "Electric lighter." M. Le Sidaner. May 9th, 1927. (290,210.)

14,441. "Ignition sparking plugs for internal-combustion engines." Miklphone Soc. Anon. May 16th, 1927. (300,479.)

17,892. "Electric power generating plants." A. B. Ruthsaccumulator. June 28th, 1927. (292,980.)

19,094. "Apparatus for making wrappers and packing incandescent lamps and the like." General Electric Co., Ltd. July 1st, 1927. (293,312.)

19,247. "Apparatus for use in the electric reproduction of sound from disk or equivalent sound records." J. Dieux. January 3rd, 1928. (Divided application on 154/28.) (300,490.)

23,445. "Alternating-current rectifiers of the metal-oxide type." Siemens-Schuckertwerke Akt. Ges. September 3rd, 1927. (296,666.)

23,736. "Lighting installation more particularly for mine workings." Siemens-Schuckertwerke Akt. Ges. October 3rd, 1927. (298,126.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 28th:—

Glyphony. No. 494,836. Class 1. Chemical substances for use in the manufacture of insulating enamels, varnishes, and substitutes for shellac, ebonite or resin.—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

Phantom. No. 492,706. Class 8. Electrical sound reproducing and amplifying apparatus for use in connection with radio-telephonic receiving sets and gramophones.—L. G. Sylvester, Scranton, Pa., U.S.A. (British representatives: Messrs. Phillips, 70 Chancery Lane, W.C.2.)

Conograph. No. 493,969. Class 8. Sound-reproducing Instruments.—John Thomson, Tsaka, Mount Row, Guernsey. (British representatives: Newburn, Ellis & Co., 70, 72, Chancery Lane, W.C.2.)

Hercuvive. No. 495,206. Class 8. Direction indicators for vehicles, electrically-illuminated advertising signs, &c.—R. D. Hughes & Son, 46, Sidney Street, Chorlton-on-Medlock, Manchester.

Barcold Automatic Electric Refrigeration (lettering and design). No. 491,204. Class 18. Refrigerating chambers. No. 491,205. Class 50. Refrigerating chests.—British Automatic Refrigerating Co., Ltd., 82, Victoria Street, S.W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ADDISCOMBE.—87 houses, Verdayne Avenue; Mr. P. Richardson.

BARKING TOWN.—Clinic and maternity block (£15,000); U.D.C. surveyor. Cinema, East Street; Mr. W. Lesadd. Factory, Harts Lane; Crow Carrying Co., Ltd.

BARNES.—Central school for girls, Lowther Estate; Surrey Education Committee.

BECKENHAM.—Depôt and firemen's quarters (£13,000); U.D.C. surveyor.

BEDFORD.—Bottle stores, &c., Gratton Road; H. Young and Son.

BEESTON.—Offices and factories for Boot's Pure Drug Co., Ltd., Nottingham.

BEXLEY HEATH.—Bazaar premises, The Broadway, for F. W. Woolworth & Co., Ltd., Kingsway, London.

BISHOP AUCKLAND.—Dispensary and welfare centre; Durham county surveyor.

BLACKBURN.—Proposed Congregational Church, Brownhills; trustees.

BOLTON.—School, at Castle Hill, Tonge Moor (£50,210); Wynne, Thomas & Button, architects, Wood Street, Bolton.

BRIGHTON.—School, Moulscombe (£13,188); R. Cook and Sons, builders, Crawley.

BRISTOL.—Proposed Baptist Church, for trustees, St. George's Baptist Church.

BURTON-ON-TRENT.—Nurses' Home (£8,000) for the B.G.; R. S. Litherland, architect, 10, High Street.

CAERNARVON.—Adaptation of the prison as county offices (£10,000); Thomas Owen, county surveyor.

COLNE.—Rewiring of Town Hall; borough surveyor.

CHARTHAM.—Nurses' home mental hospital; Kent. C.C.

CHATHAM.—Cinema (2,500 seats); Sir Oswald Stoll, Carlton House, Putney Hill, London, S.W.

CHELMSFORD.—Stores, King's Head site, High Street; F. W. Woolworth & Co., Ltd.

CROYDON.—Extensions, Maternity Home, St. James Road (£10,000); Croydon Mothers' Association. Factory extension, West Street; Hitchcock & Pearce.

CUCKFIELD (SUSSEX).—Nurses' Home for the B.G. (£4,000); clerk.

DORKING.—Secondary school; Surrey Education Committee.

DUNDEE.—Proposed new refuse disposal plant and premises (£40,000); city architect.

EDINBURGH.—Memorial hall at Colinton House, costing £4,000; headmaster, Merchiston Castle School.

EPSOM.—Passenger station, for the Southern Railway Co.: J. W. Ellingham, contractor, Dartford.

GLASGOW.—Annexe at Victoria Infirmary to cost £25,000: Watson, Salmond & Gray, architects, Glasgow.

GODALMING.—Secondary school (£43,500); Chapman, Lowry and Puttick, Haslemere.

HANLEY.—Re-erection of portion of Hall Field Pottery, Festing Street, electrically equipped (£10,000), for T. and R. Boote & Co., Burslem.

HAROLD WOOD (ESSEX).—Telephone exchange, Ingrebourne, for H.M. Office of Works, King Charles Street, London. S.W. (returnable deposit of £1 1s.).

HERNE BAY.—Additions for Herne Bay Press, High Street; Mr. C. W. Welby. Premises, Town Hall site (£18,000), for Herne Bay Estates Co., Ltd.

IRISH FREE STATE.—(NAVAN, Co. MEATH).—Rewiring County Hall for C. C.; E. J. Duffy, county surveyor.

LEAMINGTON.—Extensions, Beauchamp Hall, Beauchamp Road; Governors, High School for Girls. Twenty-one houses, Rushmore Farm Estate; Bambury & Sowden.

LEYLAND.—Senior school; director of Education County Offices, Preston.

LIVERPOOL.—Municipal abattoirs and cattle market, Hanley (over £600,000); Wm. Hall & Sons, building contractors. Elementary school, Ranworth Square, Norris Green (deposit £10 10s.); Briggs & Thorneley, architects. 612, Royal Liver Buildings.

LONDON.—(PLAISTOW, E.).—Extension of secondary school (£22,389); W. J. Cearns, contractors.

(POPLAR, E.).—108 flats, British Street (£60,000); borough engineer. Extensions, Providence Iron Works, West Ferry Road; Hooper, Cushen & Co.

(EDMONTON, N.).—Reconstruction, Angel Tavern (£20,000); Watney, Combe, Reid & Co., Ltd.

(FINCHLEY, N.).—Reception and dance hall, Great North Road; Mr. A. V. Greenfield.

(PARK ROYAL, N.W.).—Bank, Western Avenue and Park Royal Road; Westminster Bank, Ltd.

LONDON—*continued.*

(ST. MARYLEBONE, N.W.).—Buildings abutting on Finchley Road, Grove End Road, Waverley Place, and Finchley Place; T. P. Bennett & Son.

(ST. PANCRAS, S.W)..—Fifty flats, Drummond Road; St. Pancras House Improvement Society, Ltd. Block of 36 tenements, Wolcot Street area; borough engineer. Probationers' training school, Huntley Street, for University College Hospital; Michael Waterhouse, architect. Nursing home, Euston Road; Governors, Elizabeth Garrett Anderson Hospital.

(WILLESDEN, N.W.).—Secondary school, Dollis Hill; Middlesex Education Committee.

(BELLINGHAM, S.E.).—Thirty-two houses for L.C.C.; Blackwell & Meyer, of Bexley Heath.

(GREENWICH, S.E.).—Hospital extensions (£7,333), for the B.G.; J. Elliman & Son, Ltd., builders, Beckenham.

(SYDENHAM, S.E.).—Church hall (£10,000), for All Saints' parish; Rev. G. Branson, vicar.

(BALHAM, S.W.).—Maternity Home for the B.C.; B. J. Thomson, architect.

(STREATHAM, S.W.).—Theatre, Streatham Hill; Pitcher Construction Co., Ltd.

(VICTORIA, S.W.).—Buildings for Southern Railway Co., Grosvenor Road; Mr. G. Ellson.

(WESTMINSTER, S.W.).—Blocks of flats, Hertford Street, Shepherd Street, and Carrington Street; Mr. Philip Tilden. 600 tenements, Grosvenor Estate; Ashley and Newman, architects.

(ACTON, W.).—Elementary school for 950, Long Drive; Education Committee.

(W.C.).—Premises, Manette Street, for W. & G. Foyle, Ltd., booksellers, Charing Cross Road, W.C.

(HOLBORN, W.C.).—Buildings, Ridgemount Street; Trussed Concrete Steel Co., Ltd.

MANCHESTER.—Council school (1,000 places), Barlow Hall S. Hey, director of education, Education Offices, Deansgate, Manchester.

MIDDLESEX.—Extensions, Springfield Mental Hospital (£135.000); county architect.

MONTGOMERY.—Extension of the County Asylum; county surveyor.

MORECAMBE.—Alterations, Plaza Cinema; Mr. B. Duckworth.

NORMANTON.—Grammar school extensions (£17,700); West Riding Education Department, County Hall, Wakefield

PERTH.—'Bus garage for Corporation; burgh surveyor.

RAYLEIGH.—School extensions (£9,660), for Essex E.C.; J. Stuart, county architect, Chelmsford.

SALFORD.—Housing scheme (96), Gerald Road, Pendleton (deposit £2 2s.); city engineer, Town Hall.

SHEFFIELD.—School at Ecclesfield Town, near Sheffield. West Riding Education Department, County Hall. Wakefield.

STALYBRIDGE.—Extensions, West Hill and Central Schools (£14,000), for the Borough E.C.; director of education

STOCKPORT.—Extensions, Stepping Hill Hospital (£10,000), for the B.G.; Peirce & Son, architects. Electric light installation, Shaw Heath Institution, for the B.G.; clerk.

STOCKTON-ON-TEES.—Omnibus garage for the T.C.; J. P. Wakeford, borough engineer (returnable deposit of £2 2s.).

STOURPORT.—Practical subjects centre, &c., for Worcestershire E.C.; director of education, Worcester.

TUNBRIDGE WELLS.—Hospital (£.93.500), for the General and Eye and Ear Hospitals Committees; Pite, Sons and Fairweather, architects, 12, Carteret Street, London, S.W.

TYNEMOUTH.—Alterations, High Lighthouse, Dockwray Square, for Tynemouth Improvement Commission; A. K. Tasker. Receiving home for Board of Guardians, Brightman Road; W. Stockdale.

WEST BROMWICH.—Housing scheme (51); A. D. Greatorex, borough surveyor.

WESTBURY (WILTS.).—Pumping station, for Westbury and Dilton Marsh Joint Water Committee; A. P. I. Cotterell and Son, engineers, 54, Victoria Street, Westminster, S.W.

WHETSTONE.—Factory, High Road; D. & S. Autocar, Ltd.

WHITEHAVEN.—Re-instatement of portion of carpet works for the Cumbria Fibre Carpet Mill Co. (several thousand pounds).

WOKING.—Houses (38), at Old Woking, for U.D.C.; G. J. Wooldridge.